

AMERICAN JOURNAL OF ORTHODONTICS

OFFICIAL PUBLICATION OF
THE AMERICAN ASSOCIATION OF ORTHODONTISTS,
ITS COMPONENT SOCIETIES, AND
THE AMERICAN BOARD OF ORTHODONTICS

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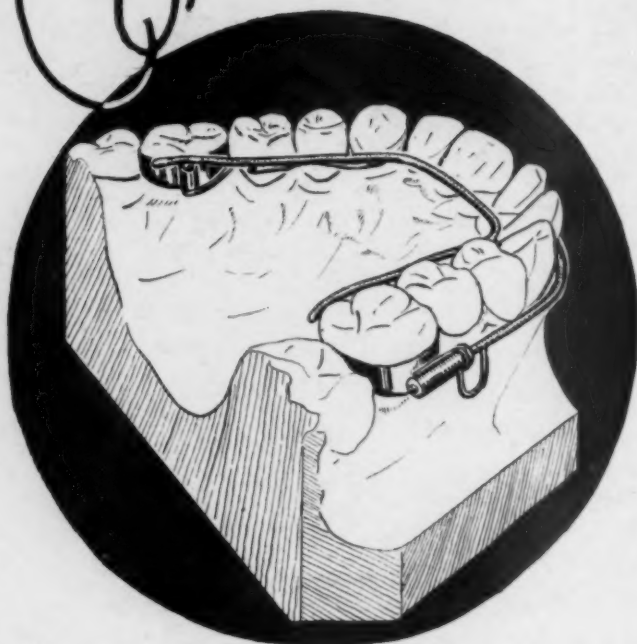
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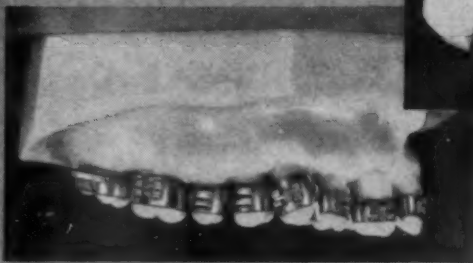
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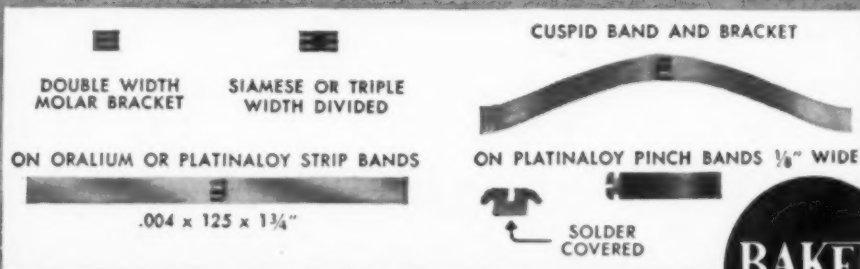
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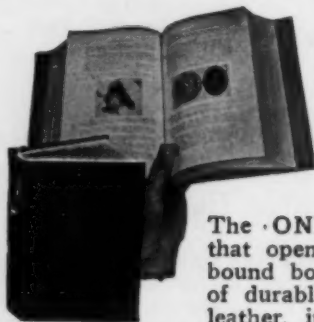
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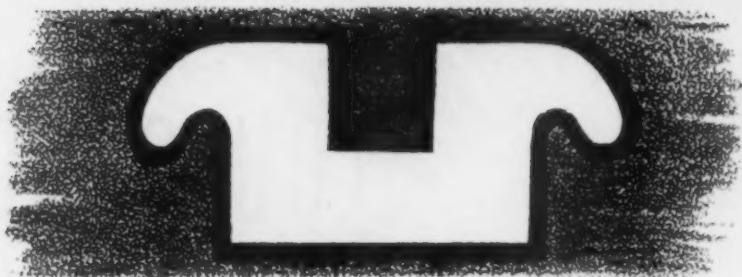
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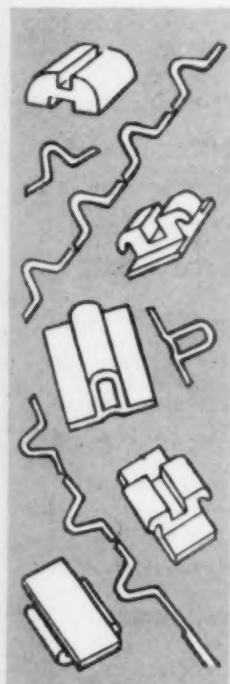
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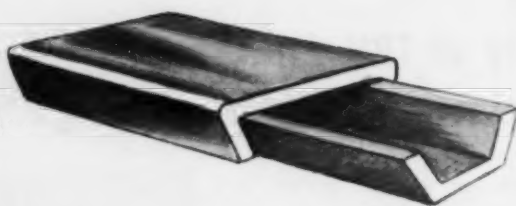
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VOL. 38

MARCH, 1952

No. 3

Original Articles

PRESIDENT'S ADDRESS

AMERICAN ASSOCIATION OF ORTHODONTISTS

JOSEPH E. JOHNSON, D.D.S., LOUISVILLE, KY.

MEMBERS of the American Association of Orthodontists and Guests:
It gives me great pleasure to welcome you to Louisville on this the fiftieth anniversary of the founding of our Association. I hope that your visit to Kentucky will be a pleasant and happy occasion and that you will carry home with you not only a wealth of knowledge gained here but a pleasant memory of Louisville and Kentucky.

Your program committee has searched the country for essayists and clinicians. They have endeavored to get young men with progressive ideas to present to you the new and to review the old. So to Dr. Clare Madden, Chairman of the Program Committee, and to Dr. James Ford and Dr. Paul Lewis who have so ably assisted him, I wish to extend my sincere thanks and appreciation.

To Dr. John A. Atkinson, Chairman of the Local Arrangements Committee, I wish to express my deep appreciation for his untiring work in arranging the hotel reservations, entertainment, etc. Dr. Joseph L. Selden has contributed much to our income by getting a large number of well-chosen exhibitors. To Dr. Burke Coomer we owe the excellent hotel and clinic arrangements and to Dr. Wallace Standard our thanks for running the registration so efficiently.

I wish to congratulate Dr. Pollock and the members of the Publication and Editorial Board for the excellent journal they have given us this year. I also wish to commend Dr. Eby for the time and effort he has given in assisting Dr. Pollock in this work.

I also want to take this opportunity to congratulate this body in having such an efficient secretary and treasurer, Dr. George Moore. His counsel and advice have been of great help.

This was presented at the meeting of the American Association of Orthodontists, Louisville, Ky., April 23, 24, 25, and 26, 1951.

Very little has transpired in the orthodontic world in the last year to bring to your attention. It has been my good fortune to attend most of the district meetings where I have found excellent programs of high caliber.

However, there is one thing I would like to call to your attention regarding the district societies and that is the lack of uniform qualifications required by the different sectional societies for membership. These qualifications should be the same as adopted by the parent body. Otherwise, in some sections of the country qualified men will find it impossible to obtain membership in our American Association and in other sections men will be admitted who are not qualified for membership. So I would earnestly recommend that this be brought up at the Board of Directors meeting and thoroughly discussed and decided upon.

I think we should take more interest in the publication of a dental dictionary. The American Dental Association has a committee working on this at the present time and I think it would be very appropriate if we had the Chairman of our Nomenclature Committee get in touch and work with the A. D. A. Committee and see if they can work out something to the mutual advantage of both organizations.

I feel we are very fortunate that our American Board has been recognized by the American Dental Association. While ours was the first dental board and the third in either the medical or dental profession, for some reason the A. D. A. has refused to recognize it until the meeting in Atlantic City last fall.

I would like to bring to your attention the fact that the Canadian Orthodontic Society has established a George Grieve Memorial Fund. This fund has been endorsed by the Canadian Dental Society. It is a well-deserved honor to one of our deceased members, and if any of you have not made your contribution yet, I am sure it will be cordially received by the Canadian Orthodontic Society.

At the present time the constitution states that only three members can be appointed to the Local Arrangements Committee. Our society has grown so large that this number is too small and it places too heavy a burden on three men. In looking back through the programs I find that the limiting number has been constantly ignored and frequently as many as ten to fifteen men are appointed on the Local Arrangements Committee. So to bring our constitution more up to date I am suggesting that Chapter 5, Section 4, be changed to read: "The Committee on Local Arrangements shall consist of as many members as the president thinks it is necessary to carry on the duties of this committee."

In closing I wish to thank the members of this association for electing me president. It is an honor I shall always cherish. Thank you.

DIAGNOSIS AND CASE ANALYSIS IN ORTHODONTICS

C. W. CAREY, D.D.S., PALO ALTO, CALIF.

ORTHODONTIC diagnosis is not a mathematical formula, nor can it be arrived at by a comparison of measured and related anatomic parts. If it were an exact science and predicated upon such variables, it would be like casting the individual in a common mold.

It is based not only upon anatomic relations, physiologic and biologic factors, but the criteria also rest upon esthetic judgment. It is, as Brodie has aptly said, an art. "Man does not select his home, clothes, automobile, nor his associates without reference to their effect upon his aesthetic senses" (Santayana).

We all look upon a patient with a malocclusion with a different eye, but still there are tangible data which may be weighed and assessed for their intrinsic values. In making a diagnosis, a careful appraisal should be made of all the factors available concerning the case at hand: the patient, his history and hereditary background; casts, photographs, dental x-rays, and cephalometric x-rays, if available.

It should first be decided when examining the patient to see if treatment is necessary: Is it possible by orthodontic means to obtain sufficient permanent improvement to justify the time, effort, and expense to be borne by the patient? Many Class I cases with slight irregularities and minor occlusal relation deviations will fall into this classification. If malocclusion exists, is it the correct time to begin orthodontic interference? Here we may encounter a great variance of opinion, not only in expressed opinions of contemporary colleagues, but also in the literature, the college program, and in the textbooks.

Our own experience is the best guide, but to gain this knowledge from experience entails making many mistakes in the trial and error method of arriving at a conclusion. Being one who has made many mistakes in judgment and having learned the hard way, I have reached the conclusion that the whole question of diagnosis does not have to be hit-or-miss, but can be reduced to a rational basis.

Experience would not be so important if we had a comprehensive knowledge of the growth and development of the jaws, teeth, and related structures. Diagnostic opinions vary with the interpretations of the scientific material presented; however, we are making progress and the cephalometer has had an important place in advancement in this field. If we are willing to study objectively the clinical work that has been done, we will be able to reach important conclusions regarding the limitations in treatment and certain factors in the growth and development of the jaws which may be substantiated by scientific hypotheses which appeal to us in confirmation of our own clinical deductions.

This was presented at the meeting of the American Association of Orthodontists, Louisville, Ky., April 23, 24, 25, and 26, 1951.

In forming opinions based on clinical material, it is important that we use material that is not fictitious. By that I mean that a case cannot be judged as a completed clinical result until after it has reverted to a passive state, which will occur several years after all retaining devices have been discarded. Models of cases after treatment and initial cuspal settling and before final settling are interesting, but not conclusive of anything except, possibly, skillful mechanical dexterity. The prognosis of their stability, however, may be fairly accurately determined by again referring to, and comparing with, work done on similar cases which have stood the test of time.

When the patient reports for examination and it is apparent that a malocclusion exists which would benefit from treatment, it is advisable to make another appointment for study models. From these models, if treatment is to be deferred, much may be learned by subsequent studies when the patient returns. The consultation should include an appraisal of the patient's head, face, stature, and parentage. Habits affecting the dentition can usually be detected at this time and questions directed concerning them. Following this, a general description of the condition is given to the parents, together with the possibilities of correction by orthodontic means. Then follows orthodontic education of the parent and child to familiarize them with the importance of the correction, the meticulous care they must exercise, and the diligent cooperation expected of them. If the patient does not want treatment, the parents should wait until he does; otherwise, treatment will only result in failure.

If it is a mixed dentition, it must be decided if it is possible to achieve justifiable benefits from treatment at this time. In my opinion, orthodontic correction in deciduous dentition should be limited to Class III cases, begun after eruption of the second deciduous molars and posterior cross-bites which interfere with mastication. In mixed dentition, treatment should be confined to the following:

- a. Anterior cross-bites as soon as incisors have erupted to contact.
- b. Posterior cross-bites, unilateral and bilateral, after eruption of the six-year molars. They are usually maxillary contractions; unilateral contractions are extremely rare and are identified by nondivergence of the median line. (Fig. 1.)
- c. Simple premaxillary protrusions induced by habit, such as thumb-sucking, lip-biting, and tongue-thrusting, and the open-bite resulting from the latter (Fig. 2).
- d. Irregularities of the upper anterior region, where space permits (Fig. 3).
- e. Maxillary protrusion cases in which there is adequate supporting bone area in both jaws, or a discrepancy not to exceed 2.5 mm. in linear dimension. Most of these will require secondary treatment, but a definite advantage may be gained from early correction of arch relation and prevention of accidents to the anterior teeth. (Fig. 4.)
- f. Class I cases in which there is a forward displacement of the lower jaw, not to be confused with Class III malocclusion. (Fig. 5.)

g. True Class III cases, with the understanding that treatment is only a poor compromise, effected by carrying the upper anterior teeth and alveolar process forward beyond the proper anatomic location in the skull, and that the lower jaw may continue to grow forward until the age of 20, making correction impossible except by surgical resection of the mandibular ramus.

h. Simple space maintenance after early loss of teeth from accident or disease, where bone area is adequate.

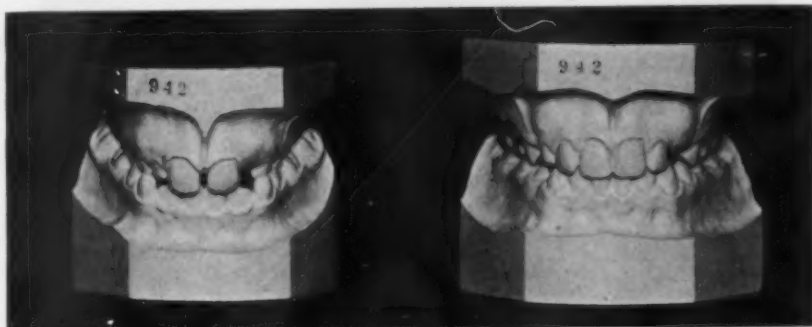


Fig. 1.



Fig. 2.

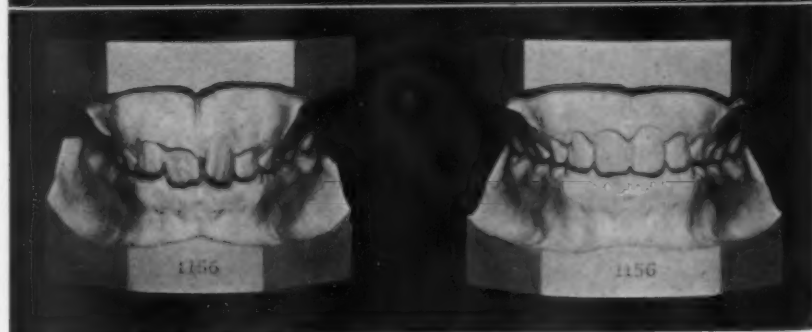


Fig. 3.

A.

B.

Fig. 1.—A, Double cross-bite. A simple primary treatment. B, After eruption of permanent teeth.

Fig. 2.—A, Thumb-sucking. Treatment at age of 8 for one year. B, At age of 15, no secondary treatment.

Fig. 3.—Dental irregularities with adequate bone space.

Mixed dentition treatment is contraindicated in cases:

a. Where a discrepancy of tooth to supporting bone greater than 2.5 mm. in linear dimension exists (Fig. 6). These cases are most advantageously treated at the last stage of transition before eruption of the cuspids. Earlier inter-

A.

B.

Fig. 4.

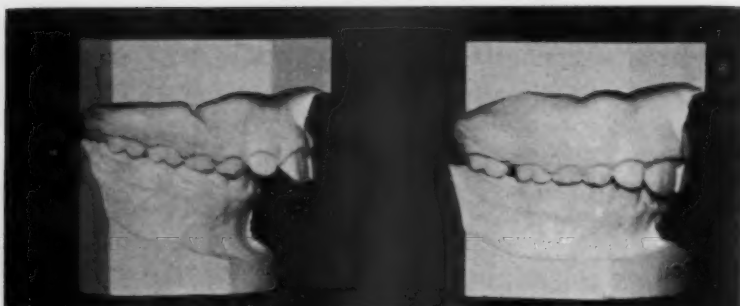
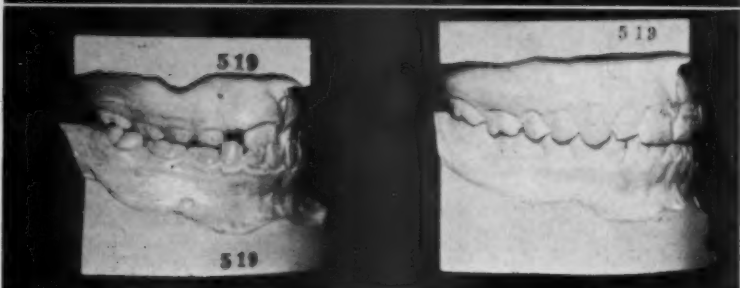
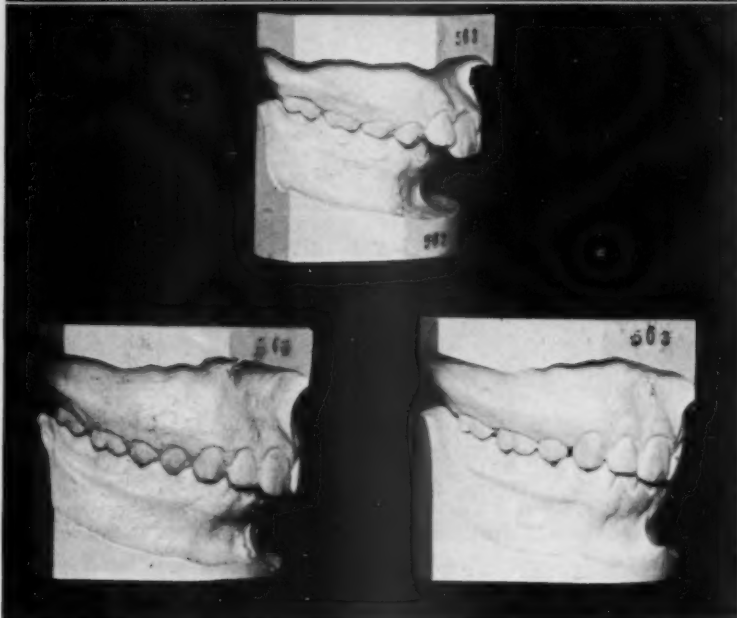


Fig. 5.



A.

Fig. 6.



B.

C.

Fig. 4.—A, Maxillary protrusion. Simple cervical treatment of upper arch. Night only. B, After nine months.

Fig. 5.—A, Class III type. Displaced mandible. Primary treatment only. B, Twelve years later.

Fig. 6.—Discrepancy case. A, Primary treatment. A waste of time. B, Failure at age of 12. C, After removal of premolars.

ference, except simple retraction of extreme labial version of upper anterior teeth, or cross-bite reduction, is a complete waste of time and effort and jeopardizes the success of the ultimate treatment.

b. In deep-bite cases, Class I, Class II, and Class II, Division 2, except the advantages which may be gained from the use of bite plates for retraction of upper anterior teeth and the mouth comfort resulting from temporary bite raising which may permit normal condyle position in the fossa (Fig. 7). It should be made clear that it is only a temporary measure and that full-time secondary treatment will be necessary.

c. In general, any case where the patient can be cared for more adequately and efficiently in the secondary dentition.

In any case treated in the mixed dentition which requires secondary treatment, the patient is wearing appliances, either active or passive, for approximately five years. Good cooperation in the active stage can be expected for approximately eighteen months. Few cases are prolonged beyond this point without loss of patient interest and some evidence of enamel destruction. The patient should be treated at the time when the least amount of mechanical therapy is required to produce the desired result.



Fig. 7.—A, Discrepancy case in which limited treatment is indicated to retract upper anterior teeth. B, After a few months with simple plate treatment.

The employment of continuous intermaxillary rubbers in mixed dentitions will only serve to increase the deformity by carrying the lower teeth forward beyond their anatomic range and create a more difficult problem for the secondary treatment. If maxillary protraction cannot be reduced with occipital anchorage supplemented by light, intermaxillary rubbers in the daytime, if necessary, it is advisable to wait for eruption of the permanent dentition.

Dr. Bercu Fischer believes that by treating Class II, Division 1 cases of deep-bite with occipital anchorage and bite-blocks, a gradual alignment takes place in the lower anterior region, which results from the release of lateral pressure from opposing teeth, and that extraction of premolars can thus be avoided in secondary treatment. I hope he is right, because it does seem to be medically incorrect to look at an abnormality and tell those concerned, "Yes, he has it, but we don't want to do anything about it for three years."

Yet, thus far, with what we know and have been able to do about it, it has been generally a waste of time, effort, and money to interfere with these cases until after eruption of the premolars. I have never seen a close-bite permanently improved by treatment instituted before these teeth have erupted; and unless this condition is corrected, very small benefit will accrue.

The casts of all patients requiring extensive treatment now or in the future are measured for linear dimension and tooth size (Fig. 8). The brass wire is adapted in the usual manner from mesial of molar to mesial of molar over the greatest diameters of the deciduous teeth (bisecting the lingual incline planes of the buccal cusps) and over the desired positions for the incisal edges of the anterior teeth. Judgment on the position of the anterior teeth may be assisted by dropping a perpendicular to the occlusal plane on the anterior ridge in line with the labial base of the alveolar process at the median line. The perpendicular may be leaned a few degrees forward, depending upon the degree of inclination desired in conformity with the facial pattern. In general, the steeper the palatal slope, the more vertical the anterior teeth, and, conversely, the flatter the slope the greater the inclination.

Of assistance in determining lower anterior tooth position and inclination is the incisal angulator (Fig. 9), which is placed on a table top with the lower cast and adjusted to position. It must be remembered that our esthetic judgment must be used along with this instrument; its mathematical exactness or ineptitude is unimportant.

For the mixed dentitions we take into account the eventual mesial drift of the first permanent molars, 1.7 mm. on each side (Nance), and use the formula $LA + 2x + 3.4$ mm. This represents the sum of the diameters of all permanent teeth from molar to molar plus the mesial drift yet to occur. We can predict with reasonable accuracy the extent of the discrepancy which may exist and will still be present when the permanent teeth erupt, whether the case is treated or left alone. If the discrepancy is less than 2.5 mm., it is minor and within the range of those acceptable for primary treatment.

If the case is a secondary dentition, or in the last phase of the mixed or primary stage and correction is indicated, impressions, photographs, and history are taken and preparations are made for treatment; an appointment is made several weeks later for the diagnosis. This gives us time to study the x-rays, the models, and photographs. Previous to the diagnosis appointment, the mesio-distal diameters of the lower and upper anterior teeth are measured on the casts and recorded on the graph paper. From this graph the arch form is outlined and the required linear arch dimension recorded. For this we use the $L.A. + 2x$ formula. Then measurement is taken of the available linear arch dimension by adapting the 0.020 brass wire on the cast from the mesial of the left lower first molar, over the premolar teeth through their greatest diameters, around and over the anterior ridge, where the incisal edges of these teeth should be located for their most favorable anatomic and esthetic position, and ending at the mesial marginal ridge of the lower right first molar. A piece of soft wax is used on the left side to help in keeping the wire in position. The arch form

of the wire should be flat and symmetrical. It is then cut off and measured. This measurement is compared with the recorded measurement of the required linear arch dimension. If it is shorter by less than 2.5 mm. or longer than the former, the patient will be treated without extraction. In this event, we will delay treatment until complete eruption of the maxillary cuspid, so that full

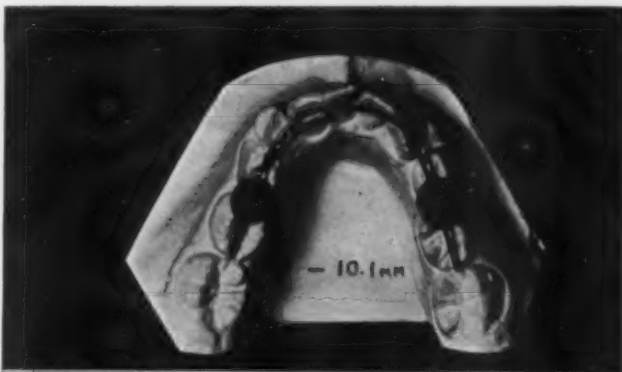


Fig. 8.



Fig. 9.

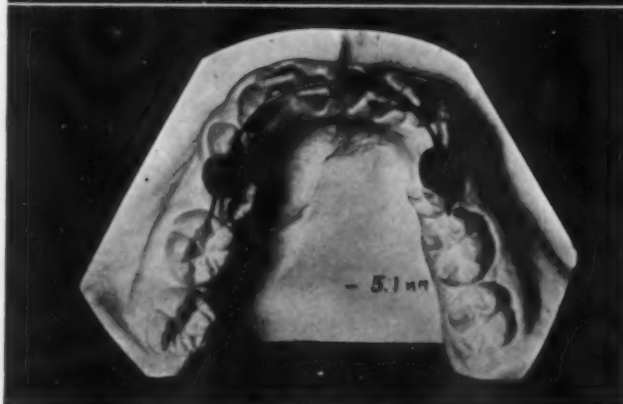


Fig. 10.

Fig. 8.—Measuring linear dimension on a mixed dentition showing a discrepancy of -10.1 mm. between bone area and combined diameters of the permanent teeth. Indicated early extraction of deciduous cuspids and first molars and preparation for extraction of first premolars.

Fig. 9.—The incisal angulator, an aid in determining position of the wire over anterior ridge.

Fig. 10.—Brass wire in position over basal bone on secondary dentition. Second premolar extraction indicated. -5.1 mm.

mechanical advantage can be obtained in maxillary anchorage. Two and five-tenths millimeters is the borderline. The decision to extract or not to extract is made by studying the position of the third molars, width of the mouth, flexibility of the labial tissues, and the facial type of the individual.

If the discrepancy is more than 2.5 mm. but less than 5 mm., consideration will be given to extraction of the second premolars (Fig. 11). Here we must study the condition of the teeth to be sacrificed and their anatomy. Also, the discrepancy may be greater in the lower arch than in the upper. The second premolars are removed in the arch with the least discrepancy. If there is a difference in mesiodistal diameter of the premolars, it must be planned so that the remaining teeth may be placed in functional relation without spacing. The upper first premolar has a longer and slightly larger crown and its presence will render a more pleasing appearance in the dental arch than the second premolar, whereas the lower first premolar is a poorer anatomic specimen than the lower second premolar. Thus, it is frequently desirable to remove the upper second and lower first premolars. (Fig. 12.) When the discrepancy is 5 mm. or more, it will be necessary to remove the first premolars, because we will need at least 2.5 mm. distal root movement of the cuspids. In these cases, all the posterior anchorage at our command will be needed to position the anterior teeth on the ridges in their most desirable positions. (Fig. 13.)

We should not ignore the possibility of removal of the first molars if they are of poor structure. Matching the extraction of lower first molars and upper second premolars will be the correct solution in some cases.

In the borderline cases of 2.5 mm. discrepancy in patients of 14 years or older, the second molars may be removed if they are of poor structure; or the third molars, before treatment begins.

A good esthetic result may be obtained by lapping the distal margin of the lower lateral incisors over the mesial of the cuspids. This will reduce the discrepancy by 1 mm. on each side. The tendency for relapse of the upper anterior teeth is not so great, and a 2.5 mm. discrepancy can be overcome without resorting to extraction, and satisfactorily maintained. (Fig. 14.)

When lower second premolars are congenitally missing and no discrepancy exists in the maxillary arch, the case often presents a problem. If there is considerable crowding of the lower anterior teeth, the deciduous molars should be extracted and spaces closed. (Fig. 15.) The maxillary teeth may be moved to secondary occlusal relation with the mandibular teeth and maintained favorably. The upper second molar must be kept at occlusal level until eruption of the lower third molar. Such a case may be treated more satisfactorily by eliminating the upper second premolar. If no maxillary discrepancy exists, distal positioning of the anterior teeth may be prevented by the employment of stationary anchorage in the anterior region during the space-closing operation. If the deciduous roots exhibit no resorption and the discrepancy and malocclusion are minor, the patient can be served best by nontreatment, as these teeth often last as long as their permanent teeth.

We frequently see extraction of upper premolars in deep-bite maxillary protractions with even anterior alignment where no mandibular discrepancy exists. These cases, in my opinion, can be treated best without extraction (Fig.

Fig. 11.

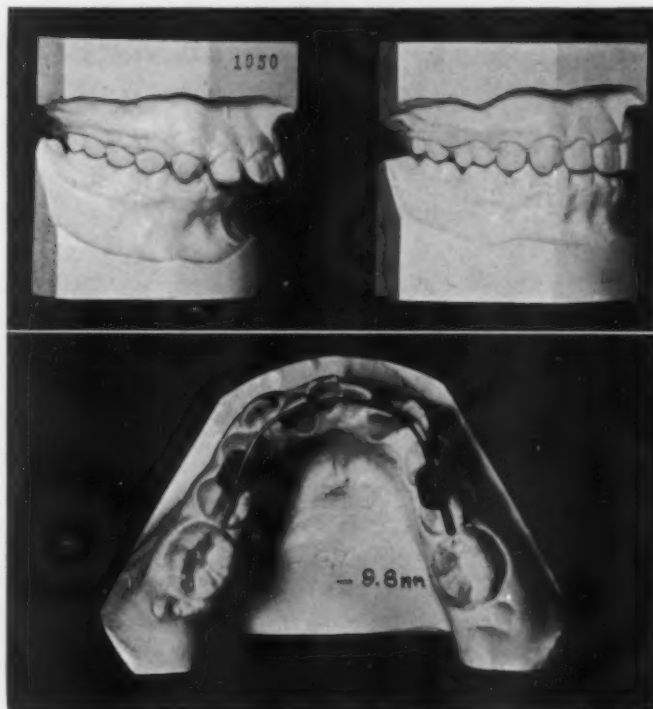


Fig. 12.

Fig. 11.—Before and after treatment of second premolar extraction case. Discrepancy, -3.5 mm.

Fig. 12.—Wire measurement shows 9.8 mm. less than enough available bone area. Indications for extractions of first premolars.

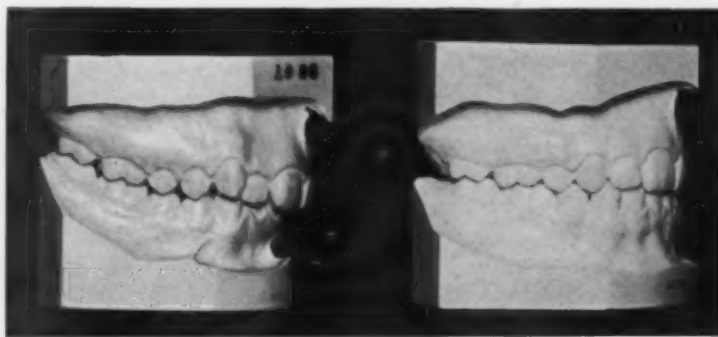


Fig. 13.—Before and after treatment of first premolar extraction case. Discrepancy, -5.9 mm.

16). In practice over the years, these are the cases that have demonstrated the most successful maintenance. They do not appear to be maxillary discrepancy cases, but have moved forward one full cusp, possibly because of environmental

pressure, disbalance, early loss of deciduous tooth structure, or perhaps accidental or chance misguidance into occlusal relation. Removal of upper premolars invites the return of a deep-bite condition which, eventually, will cause engagement of the lower incisors with the necks of the upper anterior teeth and the return of a complicated and spaced maxillary protraction.

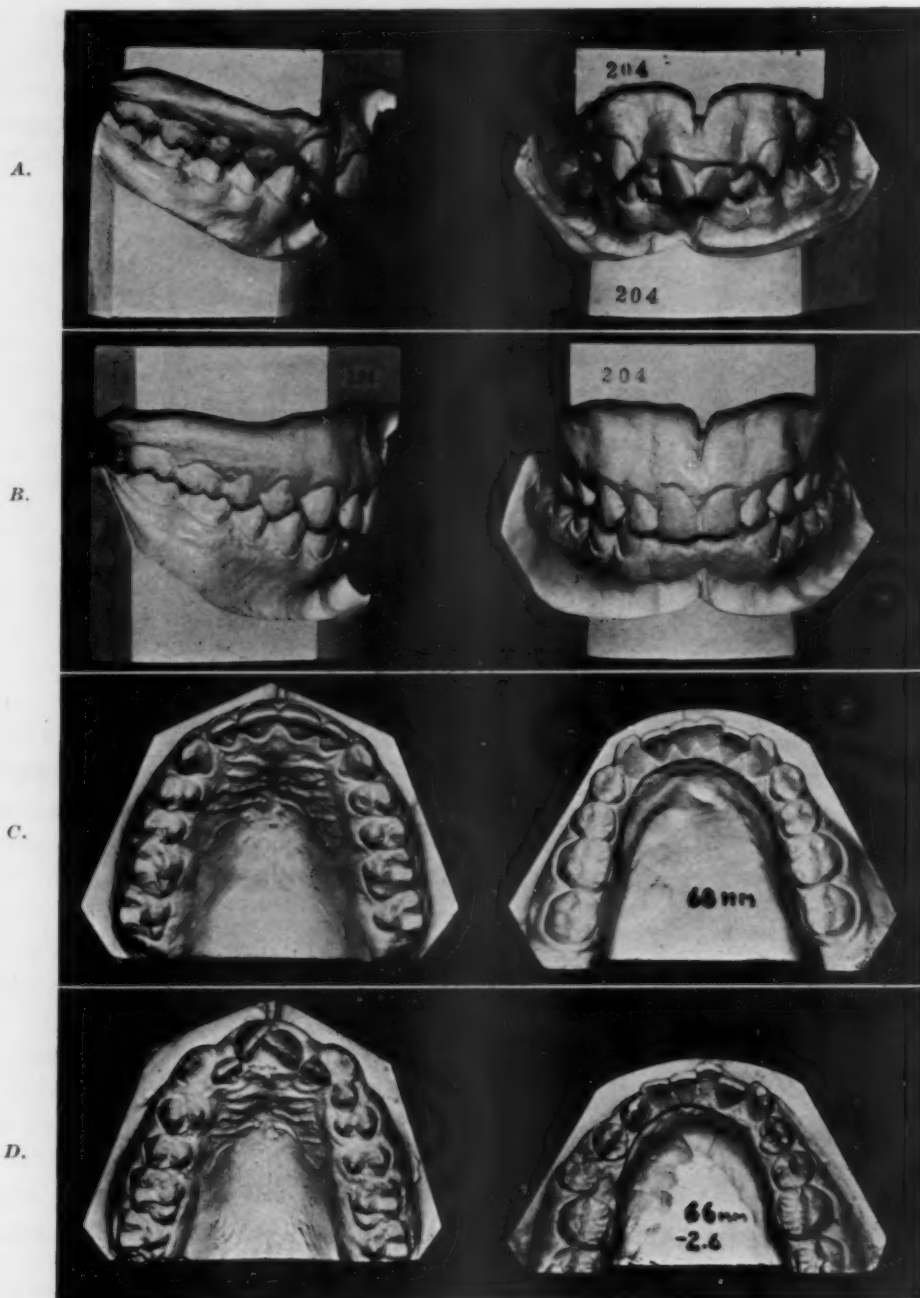


Fig. 14.—A, The borderline case. Discrepancy, -2.6 mm. Treated without extraction. B, Same case sixteen years after retention. C and D, Occlusal views show that the case has relapsed 2.6 mm. by contact point deviations, but arch relation and rotations have maintained.

There is another type of case which responds favorably to treatment and maintenance without extraction, and that is the Class II, Division 2 case (Fig. 17). The crowding of the lower anterior teeth is often caused by their abnormal



Fig. 15.



Fig. 16.



Fig. 17.

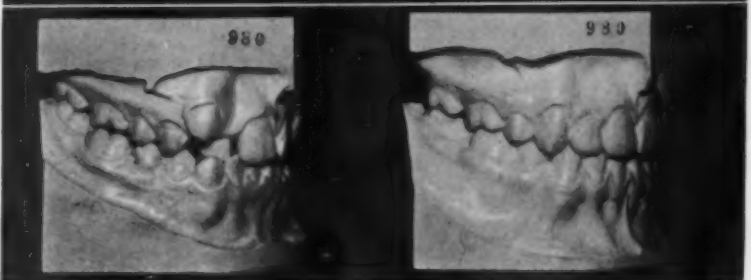


Fig. 18.

Fig. 15.—Space closure for lower premolars only.

Fig. 16.—The Class II nondiscrepancy case maintains favorably.

Fig. 17.—An extreme Class II, Division 2. Case has maintained favorably for six years.

Fig. 18.—The maxillary bone deficiency.

lingual inclination resulting from the posteriorly directed pressure of the upper central incisors, and is not a symptom of an actual arch discrepancy. These cases, which usually exhibit a complete cuspal displacement in arch relation,

will require very little distal placement of the maxillary teeth, because the mandible is locked in a pseudodistal position which, when released in treatment, assumes its normal position. These are the cases which, if left untreated, may lead to temporomandibular joint disturbances in adult life. The same displaced position of the mandible will be found in some of the deep-bite Class II, Division 1 cases, and probably accounts for the notably successful maintenance of those of the type previously described.

There are cases in which only the upper bicuspids should be extracted. These can be recognized by the thin bone in the maxilla and the extreme crowding usually characterized by displacement of the lateral incisors lingually, or blocked-out cuspids. (Fig. 18.) In the case of Class III malocclusions, removal of upper premolars may serve to increase the deformity, and it is often the best strategy to take advantage of the possibility of moving the upper anterior teeth forward somewhat beyond their normal positions in order to make less obvious the mandibular protrusion.

The x-rays should be carefully studied before and after the cast measurements are made. The findings may influence our plan of treatment. We should, of course, look for missing teeth, supernumerary teeth, anomalies in teeth and roots, root resorption, bone density, normal resorption of deciduous roots, normal development of succeeding secondary teeth, cysts, foreign bodies, caries, condition of proximal restorations, second molar position, and stage of development and position of third molars. The two latter factors will influence our decision in borderline cases. If the mesial drift of the first molars has already taken place and the lower second molars appear to be in contact with the first molars below the distal height of contour, then we can be reasonably certain that no effective distal positioning is possible, especially if the third molar crown is also in contact with the second molar. On the other hand, quite frequently we find a fairly generous space of possibly two millimeters between the first and second molars at this point in the eruption of the second molar. Just how much additional room can be expected in this area after the age of 11 is not predictable. Studies have been made, but there is not sufficient evidence to warrant dependence upon a crowded condition of the molar crowns being greatly relieved when root development is completed.

Cephalometric x-rays can well augment the usual full-mouth pictures. From head films one may gain an appreciation of the varying relationship of structures associated with the dental apparatus and obtain a more complete conception of the direction and progress of growth. There is a limit to the amount of preparatory work which we can do in private practice and still maintain treatment technique standards.

For the general run of cases, we may not need cephalometrics, but although we do not have an x-ray or a cephalometer in the office, the problem cases can and should be referred to a competent laboratory for cephalograms.

This brings us to the final step in diagnosis—the photographic analysis. Just as with cephalometric x-rays, photographs mean more when one has studied many. It is surprising that, when the patient was present, many things about

the face and head were not accurately observed. And then, when the diagnosis was being prepared for analysis, the patient was not present. The usual planes are marked on the prints: orbital, horizontal, and mandibular; and the mandibular angle is recorded. We observe these photographs, first noting the general form of the face and head, then the relationship of the lower to the upper part of the face. Are the lips in a relaxed position? Do they appear to be distorted by the malposition of underlying structures? Does the mandible appear to be short or is it displaced distally? The cephalogram may help us here.

A silhouette of an attractive lip relation and lower profile may be superimposed over the profile photograph to visualize better what improvement might take place if the lips were retracted, or what it would mean to the face if they were brought forward. We can expect approximately 3 mm. lengthening of the face from the horizontal plane to the symphysis from natural growth between the eleventh and thirteenth years. This lengthening will reduce some of the protrusive appearance by virtue of its relation to a longer line. The lower lip is thrust forward with reduced curve in Class I double protrusions, and in Class II arch relation it is curved markedly at degrees varying to over 90°.

In dental protrusions where the rotations are extreme, the lips often assume normal relationship and should not be disturbed in any way. Care must be taken to preserve this relationship by assuming that the anterior teeth are already located in their correct labiolingual anatomic positions. The maxillary discrepancy cases will usually exhibit prominence of the lower lip, very little curvature, and a flattening of the entire profile below the nose. It is difficult to improve this with treatment.

The Frankfort-mandibular plane angle should be our concern in this study. Dr. Tweed's information on this has proved to be helpful. If the angle is over 35°, we can expect little improvement following correction of the dental condition.

After evaluation and consideration of all these factors, the diagnosis and plan of treatment are written up in condensed form on the back of the graph, which is attached to the working card so that it is readily available. It should include, in order: type of malocclusion; relation to cranium; etiology; arch discrepancy in millimeters; arch relation; position of third molars; and photographic analysis. Below this is a brief outline of the treatment plan and retention. Five lines will usually suffice. If it is long and involved, it will not be referred to and might just as well be placed in the filing case with the other masses of material gathering dust.

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616 UNIVERSITY AVE.

THE ROLE OF CEPHALOMETRICS IN ORTHODONTIC CASE ANALYSIS AND DIAGNOSIS

WILLIAM B. DOWNS, D.D.S., M.S.,* AURORA, ILL.

ORTHODONTIC case analysis is a procedure which includes the study of the relationships of the component parts of the face in order to appraise their status of balance and harmony. It is the purpose of this portion of the symposium to discuss only this phase of case analysis, particularly in the light of information that may be gained from the use of the cephalometric roentgenograph.

When a person develops a malocclusion of the teeth, he presents a problem far more complex than the relationship of dental units. An appraisal cannot be adequately prepared without a consideration of the relationships of all the component parts of the head, the status of tissue metabolism, and the environmental influences of the forces of occlusion.

A study of the form of the head presents a four-dimensional problem; height, width, depth, and time. The lateral cephalometric roentgenograph (headplate) offers an ideal medium for studying three of these dimensions; namely, height, depth, and time.

The profile of the face has long been a consideration in art, comparative anatomy, anthropology, and orthodontia. Camper (1786) was one of the first to measure the relationship of the face to the head. His work is credited as the beginning of the modern science of anthropometry (Wilder¹). Camper (Fig. 1) recorded the angular relationship of a plane through the external auditory meatus and the anterior nasal spine to a plane tangent to the forehead and face. He said, "The angle which the facial or characteristic line of the face makes, varies from 70 to 80 degrees in the human species. All above is resolved by the rules of art, all below bears resemblance to that of the apes." The vagueness of locating the planes in this early work was not well suited to precise scientific use. Consequently, the ensuing years brought modifications to provide greater accuracy.

Flower's gnathic index (Fig. 2) satisfied the dictates of accuracy. It was determined by the ratio of the basion prosthion distance to the basion nasion distance $\frac{B - P}{B - N} \times 100$ and gave the following index of prognathism.

X- 98	orthognathous
98-103	mesognathous
103- X	prognathous

The next basic advancement (Fig. 3) came with the adoption of the Frankfort horizontal plane in 1884. The FH was substituted for Camper's base plane of external auditory meatus to anterior nasal spine and the facial

*Professor of Orthodontia, University of Illinois.

This was presented at the meeting of the American Association of Orthodontists, Louisville, Ky., April 23, 24, 25, and 26, 1951.

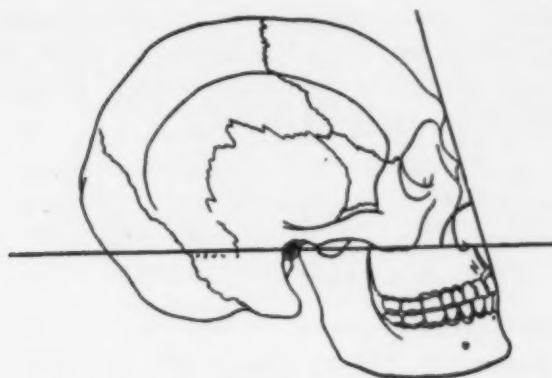


Fig. 1.

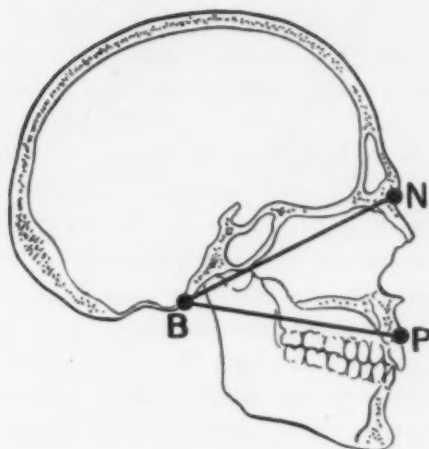


Fig. 2.

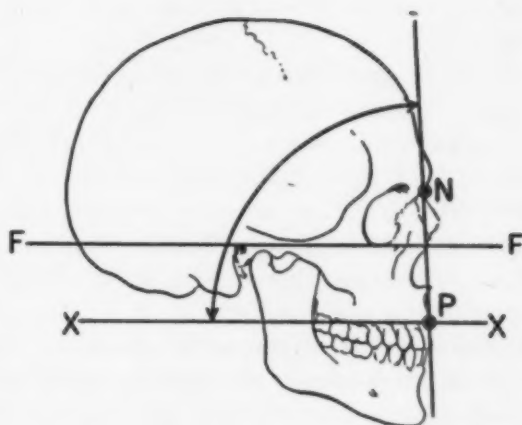


Fig. 3.

Figs. 1 to 3 show anthropometric techniques of evaluating prognathism.

Fig. 1.—Camper, 1786.

Fig. 2.—Flower's gnathic index.

Fig. 3.—Facial profile angle.

plane, tangent to the forehead and face, was defined as a plane passing through nasion and prosthion. This accurate locating of planes permitted precise measurements and the designation of the Facial Profile Angle NPX which Wilder¹ called "the modern equivalent of the Facial Angle of Camper." The following values of the Facial Profile Angle are given:

Hyperprognathous	70°
Prognathous	70°-80°
Mesognathous	80°-85°
Orthognathous	85°-93°
Hyperorthognathous	93+

The term prognathism appeared in the anthropological and anatomical literature in the nineteenth century and became well established as a specific condition by 1850 largely through the work of Prichard.²

A detailed historical review of the earlier methods of studying the facial profile will be found in Björk's³ monograph "The Face in Profile." This outstanding work is highly recommended to all who are interested in the form of the face.

According to the techniques of this era for expressing prognathism, the relative anteroposterior position of the upper face or maxilla was the determinant—no consideration was given to the position of the mandible.

These early classifications have proved very valuable in anthropometric studies of racial characteristics. However, they are quite inadequate for the orthodontic needs of appraising the status of balance and harmony of the dentofacial complex. In the first place, the methods disregard the contribution of lower face or mandible to the facial profile. Second, the lower terminus of the facial plane (superior prosthion) is at the anterior-inferior limit of the maxillary alveolar process which in itself is subject to considerable variation in response to tooth movement. Prosthion basically is not a skeletal point; it is a denture point.

About 1880 the word prognathism appeared in the dental literature. Dental usage began to apply the term to the lower jaw and confusion arose regarding the meaning of prognathism. More recently the term DP or dental protrusion has appeared in our literature; this latter condition is often confused with prognathism. Björk⁴ defines DP as alveolar prognathism and distinguishes between this condition and facial prognathism. It is unfortunate that such confusion and lack of agreement should prevail in the terminology used to describe the facial profile.

Because of the proved value of the anthropometric term prognathism in describing the relative anteroposterior relationship of the face to the cranium, we as orthodontists will do well to accept and use this term in its original meaning. It seems necessary, however, that we have a more complete description of the facial profile, one that includes the mandible and the denture, and there is some justification for the dental use of the word "gnathic" when referring to the chin. Todd⁵ said, "But since the Greek word gnathos strictly signifies the lower jaw, the term may be used equally well for the mandible." Webster's *New International Dictionary* uses the word *gnathos* in the definition of chin.

Observation of faces shows that they vary a great deal and we have become accustomed in orthodontics to think of them in terms of the position of the mandible. The four faces in Fig. 4 illustrate this in individuals having normal occlusions. *B* is the average facial type. It might even be called the ideal, for to most people it represents the best harmony of features or beauty of form for the white race. *A* has a recessive lower face but still is harmonious in its proportions. *C* is also harmonious but has a protrusive lower face. *D* has a face projecting beyond the cranium and illustrates true prognathism but in a mild degree. This case has a Camper facial angle of 72, a gnathic (Fowler) index of 102, and a facial profile angle of 82.

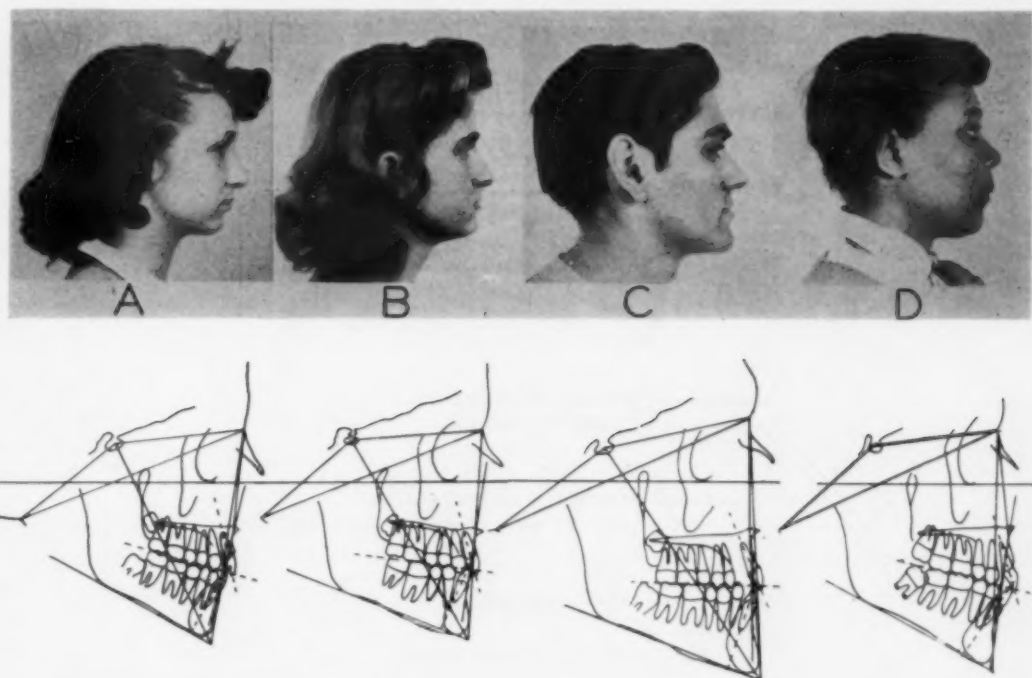


Fig. 4.—Examples of facial types that are in balance and harmony. *A*, Retrognathic; *B*, mesognathic; *C*, prognathic; *D*, prognathism.

In describing these facial profiles, the anthropometric term prognathism has been retained and called true prognathism, and the suffix gnathic has been used to denote chin. Thus the face of average profile *B* may be called mesognathic, the one with a retrusive chin *A*, retrognathic, and the one with a prominent chin (*C*), prognathic, and the one in which the total face projects beyond cranium (*D*) is called true prognathism. One may prefer one facial type to the others but one cannot change them (except by surgical techniques) because they are basically determined by the skeletal pattern of the individual.

These faces not only vary in the relative anteroposterior position of the mandible, but they also differ in the degree of convexity of the profile. Thus, we have two primary factors influencing the profile. The variation in each factor is considerable within the normal range. Of equal importance with these usual

differences is the correlation of the two factors. The individual factors of the anteroposterior position of the chin and the convexity of the face may be acceptable, but if they are not put together properly in the same individual, disharmony results. The primary and secondary correlations of the facial angle with facial convexity are shown in the diagram (Fig. 5).

Primary correlations result in the best harmony and balance for the type. Secondary correlations may represent good balance and harmony. I might add that both factors are influenced in degree by facial height.

FACIAL TYPES

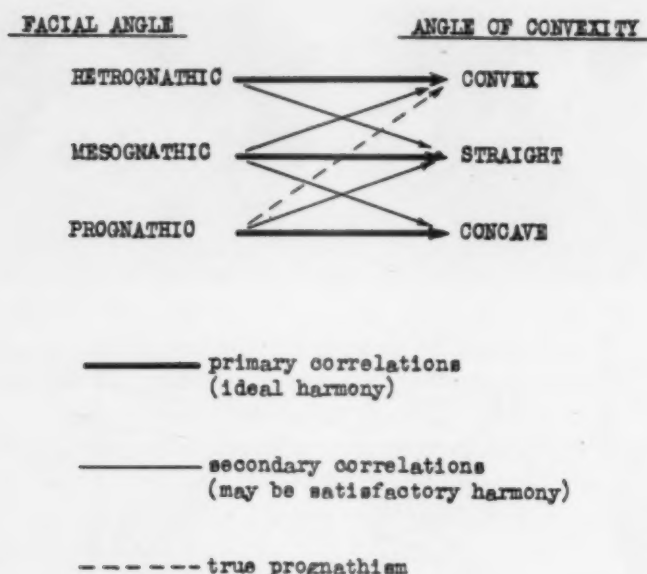


Fig. 5.—Correlation of facial types.

Typing of faces is well known. It has been done from photographs, from skulls, and by direct measurement. Hellman⁶ measured directly nineteen dimensions on the faces of a large group of male adults. He determined average dimensions and the standard deviation for each. From these data he developed the polygon of the average and the variations of facial features which he called the "wiggle" of facial features.

Static analysis may be defined as the expression of a condition of relationships at a particular time. Dynamic analysis results from a comparison of two or more static analyses.

STATIC ANALYSIS

Cephalometrics is to the orthodontist what the dissecting room is to the anthropologist and anatomist. It permits him to examine the foundation over

which musculature is draped. This is shown in Fig. 4 by the x-ray tracings of the skeletal patterns of the four facial types.

The face is basically composed of a maxilla and mandible with a denture (teeth and alveolar process) interposed between them. The author⁷ introduced before this association in 1948 a method of recording the skeletal and denture

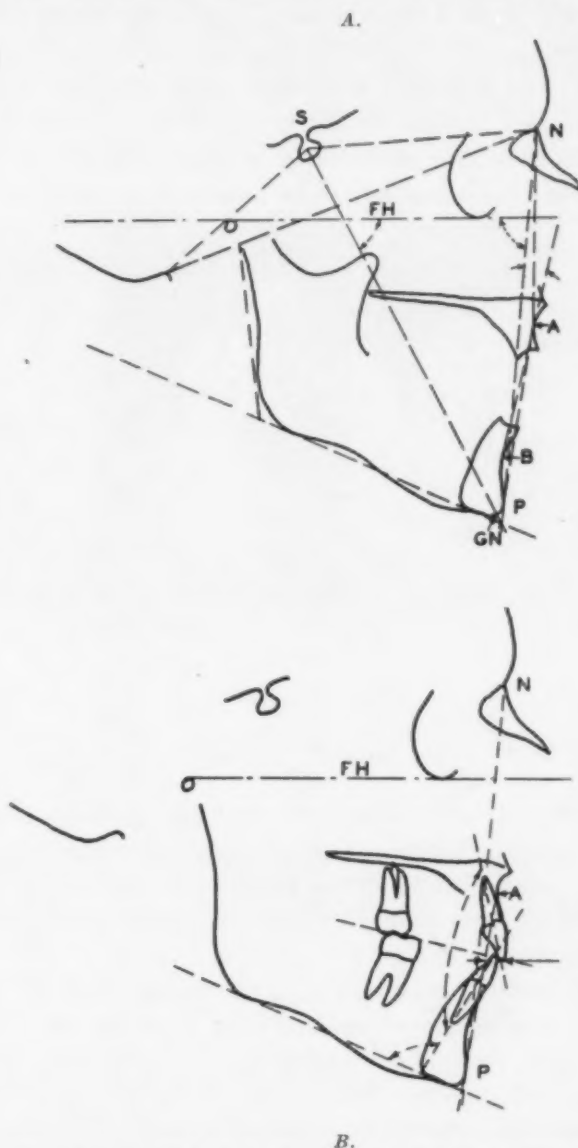


Fig. 6.—A method of diagramming the A, skeletal and the B, denture patterns. (Downs W. B.: AM. J. ORTHODONTICS 34: 812, 1948.)

pattern by which the facial skeleton may be patterned and its form measured by drawing a few lines through anatomical points. Likewise, the denture may be defined and measured in relationship to the skeleton (Fig. 6).

The readings used to describe these patterns for a mixed sample (12 to 17 years of age), who had normal occlusions, are given in Table I.

This serves as a guide which may be used to appraise the facial pattern of individuals of similar ages. It was soon realized, however, that the mean values of an angle or a dimension differ with age but in an orderly, progressive manner. This is but an expression of the growth of the face from birth, when it constitutes one-ninth of the head, to maturity when it comprises one-third of the head. To date we do not have complete data on the mean values for different ages. The figures in Table I give the maximum and minimum ranges and the mean values with their standard deviation. One standard deviation plus or minus from the mean will include 68.26 per cent of the sample, two standard deviations will include 95.46 per cent. If a reading is much more than two standard deviations from the mean, it can be assumed to represent an unsatisfactory proportion.

TABLE I

DENTURE PATTERN				
	MINIMAL	MAXIMAL	MEAN	S.D.
Cant of occlusal plane	+1.5	+14	+9.3	3.83
1 to 1	130	150.5	135.4	5.76
1 to occlusal plane	+3.5	+20	+14.5	3.48
1 to mandibular plane	-8.5	+7	+1.4	3.78
1 to AP plane	-1 mm.	+5 mm.	+2.7	1.80
SKELETAL PATTERN				
	MINIMAL	MAXIMAL	MEAN	S.D.
Facial angle	82	95	87.8	3.57
Angle of convexity	-8.5	+10	0	5.09
AP plane	-9	0	-4.6	3.67
Mandibular plane	17	28	21.9	3.24
Y axis	53	66	59.4	3.82

The question arises as to what is normal. Hellman quite aptly said, "Variation is normal." Subjective studies of excellent occlusions have given us central tendencies in the relationships of the parts of the face, and by using the statistician's tool "standard deviation" we learn the acceptable degree of variations from the mean or central tendency.

The standard deviation is accepted as a statistical method of expressing variation and is quite satisfactory when used with a normal distribution curve. It does not work quite so well when dealing with a sample not symmetrically distributed about the mean value. Since four of the ten distribution curves exhibit appreciable lack of symmetry, a consideration of the maximum and minimum ranges from the mean is important in an interpretation of the cephalometric readings.

One of the major objectives in developing a cephalometric method of appraising the facial skeletal pattern was to correlate the resulting description as closely as possible with the facial type as indicated by direct observation or by study of photographs. In a test of several of the more commonly used reference planes, the Frankfort Horizontal (FH) was found to be the most reliable.⁷

No correlation was found between either the SN plane or the Bolton plane and the facial profile. Even the FH is not always as reliable as we would like. This plane is said to approximate a level position when one is standing in a posture of distant vision. A test of the levelness of FH on one hundred orthodontic patients as they presented for examination was made by photographing them standing. They were asked to look at their own eyes in a mirror placed five feet in front of them. The mean position of FH deviated $+0.9$ degree from level. Plus was used to denote a plane that tipped up in front. The standard deviation of 5.0 seemed high. How much poor posture affected the readings has not been determined.

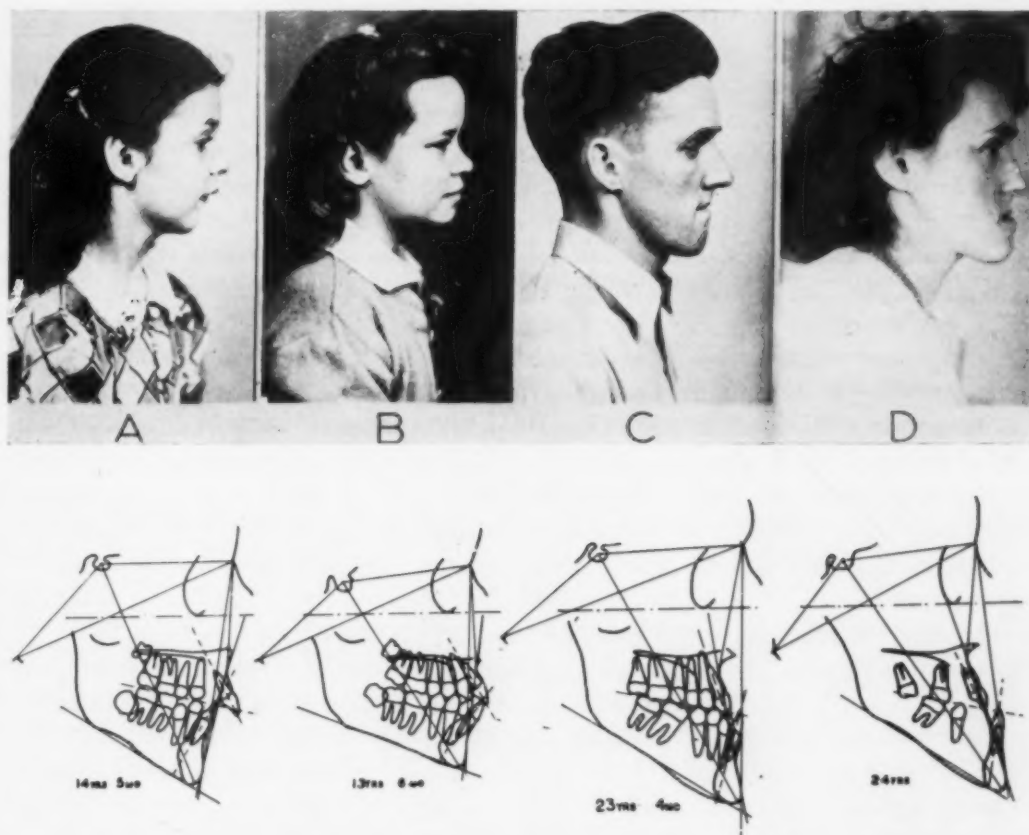


Fig. 7.*—Examples of facial types showing disharmony. A, Retrognathic; B, mesognathic with a minor degree of true prognathism; C, mesognathic with a high degree of convexity; D, prognathic.

*The changes in these patients subsequent to orthodontic therapy may be seen in an article published by the author.¹

Now we can return to the photographs and tracings (Fig. 4) used to represent four facial types and numerically evaluate their respective cephalometric x-rays. The description of the individual patterns is given in Table II along with the means and standard deviations of the normal occlusion group for comparison.

These cases while varying considerably in facial form all represent quite acceptable balance and harmony and all of the readings fall within the acceptable ranges of the standard deviations.

TABLE II

SKELETAL PATTERN						
	A	B	C	D	MEAN	S.D.
Facial angle	82	86.5	92	90	88*†	3.5†
Angle of convexity	+6	0	-4	+14	0	5
AB plane	-5.5	-4.5	-3	-9	-4.5	3.6
Mandibular plane	28	21	20	28	22	3.2
Y axis	64	60	55	62	59.5	3.8
DENTURE PATTERN						
	A	B	C	D	MEAN	S.D.
Cant of occlusal plane	+16	+8	+1.5	14.5	+9.5	3.8
1 to 1	136	140	140	125	135.5	5.7
1 to occlusal plane	+14.5	+17	+15.5	+23	+14.5	3.4
1 to mandibular plane	+1.5	+3.5	+35	+7	+1.5	3.7
1 to line AP	+4	+3	-3	+9	+2.5	1.8

*Refer to Table I for comparison with the maximum and minimum ranges of each reading.

†For practical use the mean is given to the closest ½ degree and the last decimal of the S.D. has been dropped in Tables II through VI.

For comparison with cases exhibiting lack of balance and harmony, we may examine the four individuals shown in Fig. 7. The tracings show the qualitative form of the patterns and Table III gives the quantitative description.

TABLE III

SKELETAL PATTERN						
	A	B	C	D	MEAN	S.D.
Facial angle	82	88.5	90	96	88	3.5
Angle of convexity	+11.5	+10	-22	-22	0	5
AB plane	-9	-6	+11	+12	-4.5	3.6
Mandibular plane	32.5	22	31	34	22	3.2
Y axis	67.5	58	60.5	56	59.5	3.8
DENTURE PATTERN						
	A	B	C	D	MEAN	S.D.
Cant of occlusal plane	+16	+8.5	+10	+13	+9.5	3.8
1 to 1	124	117.5	149	143	135.5	5.7
1 to occlusal plane	+13	+28	+4	-4.5	+14.5	3.4
1 to mandibular plane	-2	+14.5	-18	-25	+1.5	3.7
1 to line AP	+11.5	+7.5	0	+1 mm.	+2.5	1.8

Refer to Table II for comparison with normal occlusions.

A brief study of these figures in comparison with the mean value and the standard deviation of the normal occlusion group will point out the areas of disharmony. The greatest deviation from the average occurs in the angle of convexity and in the position of the incisor teeth.

To date the most significant findings of a static cephalometric analysis by this method of appraisal which have a bearing upon treatment planning and prognosis are:

1. A numerical description of the facial skeletal profile. Currently many believe this to be governed by hereditary potentials and not subject to change during orthodontic therapy except by surgical procedures or by correction of abnormal condyle relationships. Others believe that corrected occlusions, through function of the dentofacial complex subsequent to orthodontic therapy, can modify the growth pattern of the face. To date I do not know of sufficient cephalometric data to refute or concur in either belief.

2. A knowledge of facial type has some value in visualizing what one may expect when a patient reaches maturity.

3. The anteroposterior relationship of the denture bases which are indicated by points *A* and *B* (Fig. 6, *A*.) This is expressed by the relationship of a line through *A* and *B* to the facial plane (a line from nasion to pogonion). The mean of this angle is -4.6 degrees, S.D., 3.67. Within one standard deviation of variation little difficulty should be experienced in treatment. Beyond this, the problem becomes proportionally more difficult until it reaches a point of impossibility of obtaining good harmony.

4. High mandibular plane angles complicate treatment and prognosis, but this angular reading in itself is not sufficient to indicate the nature of the difficulty that may be experienced. High mandibular plane angles occur in both retrusive faces and protrusive faces. The California analysis which measures the effective length of the mandible is important in a differential analysis of the mandibular plane angle. A correlation of the facial angle with the mandibular plane angle is also helpful. The study of normal occlusions showed a negative correlation of 0.726, meaning that the protrusive chin normally is associated with a low mandibular angle and a retrusive chin with a higher mandibular plane.

5. The axial inclination of the lower incisors to the mandibular plane does not appear as important cephalometrically to harmony and balance of the denture as does the relationship of the lower incisor to the occlusal plane. This can be explained by the fact that there is such a great variation in the mandibular plane angle and that the occlusal surface represents the functioning surface of the denture.

6. The relationship of the incisal edge of the upper central incisors to the plane AP tells a great deal about the protrusion of the denture (Fig. 6, *B*). It will be noted that the standard deviation of this variation is quite small, 1.8. There is also a correlation of the position of the upper incisors to the angle of convexity. The more convex the profile the farther forward the maxillary incisal edge may be to the plane AP. An excessive forward relation of the denture is known as DP and should not be confused with prognathism. It is, however, common to have both present in the same individual.

A discussion of the clinical use of cephalometrics would not be complete without including an "Assessment of Anterior-Posterior Dysplasia," known as

the California analysis (Fig. 8). It was introduced by Wylie⁶ in 1947 and has for its objective an anteroposterior appraisal of the upper face to the lower face—more specifically the maxilla to the body of the mandible. It is accomplished by lineal measurements along the Frankfort Horizontal of projections of upper and lower skeletal points to this plane. By a cleverly worked out system of cancellation, one arrives at a score indicating whether the lower face is protrusive or retrusive to the upper face. It also gives the degree of difference. A score of 0 is taken as the mean. Excessive readings indicate problems in treatment because of dysplasia of the skeletal pattern in anteroposterior relationships.

ASSESSMENT OF ANTEROPOSTERIOR DYSPLASIA				
Female				
Dimension	Standard	Patient's	Orthognathic	Prognathic
Glenoid fossa to sella	17	17		
Sella to ptm.	17	15		2
Maxillary length	52	60	8	
Ptm. - 6	16	25	9	
Mandibular length	101	113		12
P.S. 9 Age 13		Totals:	17	14
Units of anteroposterior dysplasia = prognathic-orthognathic:			-3	

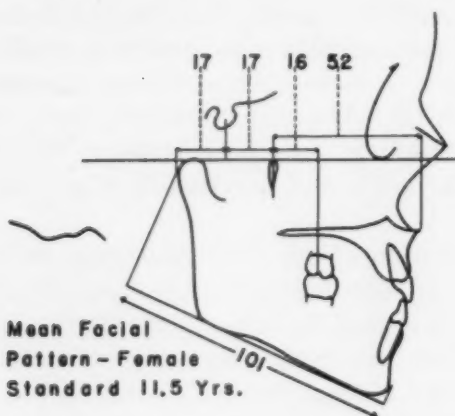


Fig. 8.—The California analysis. (From Wylie, W. L.: Angle Orthodontist 3: and 4: 97, 1947.)

The significance of this analysis, however, is not so much in the score; more important is the breakdown of relationships of parts. As I interpret this assessment, Wylie has done two things. First, he has given averages in the relationship of the maxillary (pterygomaxillary fissure) and mandibular (condyle) growth centers to the cranial base using sella turcica as a reference point. The correlation of the relationship of these growth sites can affect the profile. The second important interpretation is the correlation of the actual effective length of the maxilla and mandible. Unfortunately, his standards are

only for one developmental age. This does necessitate some element of estimating when using the assessment for different ages. Anyone using cephalometrics will want to understand the significance of the California analysis.

So far this discussion has been limited to a static relationship of the component parts of the face as interpreted by the cephalometric x-ray, and has given two methods of quantitative appraisal of the dentofacial complex by which it may be accurately described. The orthodontist's concern is balance and harmony. If he achieves this functionally and esthetically, he will have accomplished his objective in the management of a given case. He will also probably have obtained the most favorable position for the maintenance of optimum health of the supporting tissues of the denture.

Of increasing importance, but not too well understood as yet, is the variation of the growth pattern and its possible relationship to facial types.² This introduces the second phase of cephalometrics which is the dynamics of morphologic change occurring with growth and development.

DYNAMIC ANALYSIS

Before entering upon a discussion of growth, the dynamics of mandibular movements should be discussed. Many studies have been made of the movements of the condyle. Recently Thompson's⁹ work on functional occlusion has made this phase of analysis routine practice. The accepted average movement of the condyle in relation to the fossa may be described as follows: in the initial stage of opening from occlusion to rest position, there is a hinge action with the center of rotation in the condyle; further opening involves a forward translation of the condyle.

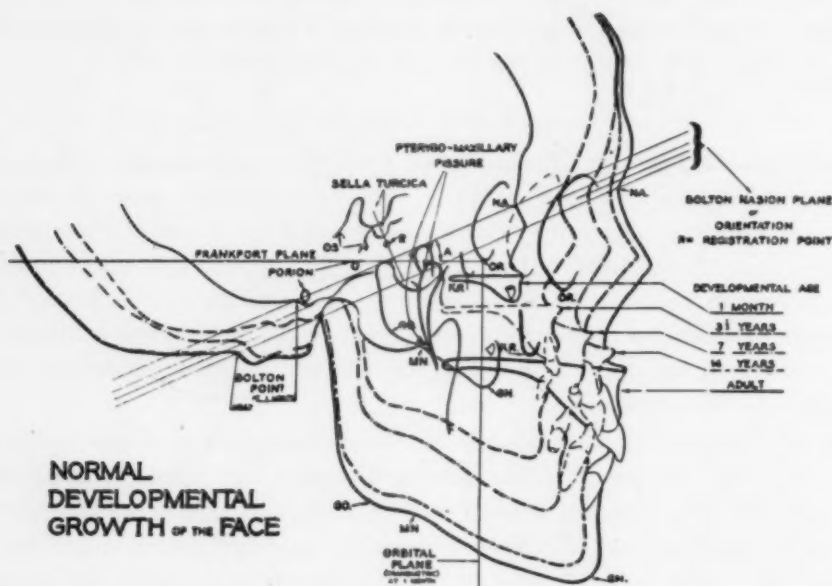
It is well known that anterior or posterior translation of the condyle does occur during the movement from rest to closure; and when it happens it is considered abnormal and has become known as mesial, distal, or lateral thrust. This condition, if present, should be discovered in a clinical examination of functional occlusion and may be recorded cephalometrically by comparing tracings made from rest position and from occlusal contact films. The diagnostic criteria are found in the direction of the path traveled by gnathion from rest to occlusion and in a comparison of the position of the condyles. These same tracings also record the interocclusal space which averages about 3 mm. at the incisors.

Should one find abnormalities of condylar movement, additional more detailed information may be obtained from lateral condyle pictures or from the newer technique of cephalometric laminagraphy as described by Brader¹⁰ and Ricketts.¹¹

When one prepares an analysis of a case of malocclusion with the intent of developing a plan of orthodontic management, he first studies the relationship of the dentofacial complex and the forces of occlusion which are or have been operative to create the malocclusion. If he could also obtain some information of the growth potential of his patient, it would be of great help in planning treatment and prognosis. This can be best and most accurately obtained

by having semiannual or annual serial head films during an observation period preceding treatment. However, this is not always possible and much help can be gained from single pictures.

The average or mean pattern of facial growth has been well established through the investigations of Broadbent and Brodie. Broadbent¹² said in 1941, "After the pattern of the face is established at the completion of the deciduous dentition, it is significant that contrary to current belief, there is no marked change in the proportion of the face thereafter. It consists of a more or less proportionate increase in size." And again in the same article, "Thus it is seen that an assembly of dento-facial patterns of normal individuals of different ages expresses the same orderly and uniform pattern of growth that is revealed by the serial records of our longitudinal study of the same individual."



Normal developmental growth of the face from the Bolton Study records. A—Angle of Frankfort plane of the first record to the Bolton-Nasion plane of orientation. GN—Gonion. GO—Gonion. KR—Key Ridge. NA—Nasion. OR—Orbitale. OS—Occipito-sphenoidal suture. MN—Mandibular notch.

Fig. 9.—Mean pattern of facial growth. (From Broadbent, B. H.: *Angle Orthodontist* 11: 223, 1941.)

Brodie,¹³ about the same time, in a serial cephalometric study using x-ray records from 3 months to 8 years of age, arrived at a similar finding to those of Broadbent. He said, "The most important single finding is that the morphogenetic pattern of the head is established by the third month of post natal life, or perhaps earlier, and that once obtained does not change."

These concepts of facial growth are expressed by the diagram in Fig. 9 taken from Broadbent's¹⁴ 1937 article.

These statements made some years ago by two leaders in this field of study have tended to lead us into a state of complacency and finality about the way

the face grows. Evidence that these concepts were not to be so literally construed is found in a statement by Broadbent¹⁴ again in 1937.

This failure of the facial mass of the twin T to emerge from under the brain case and attain the same proportion in relative position to the cranium that the control twin C has attained is in the writer's opinion one of the greatest handicaps that orthodontic therapy is called upon to face. The progress of each of these individuals between eleven and one-half and twelve and one-half years in dento-facial development may be seen in Fig. 15 where their first record is superposed on those of the second and fourth. During this year's interval of observation the more vigorous growth of C in the maxilla and mandible especially at the apical bases accounts for the improvement in arch form and size and axial inclinations of the teeth, that failed to take place in T.

It must be remembered that Broadbent's diagram (Fig. 9) is derived from averages of facial growth in longitudinal studies and that it is a composite. It, therefore, represents the mean pattern of facial development. The patients whom the orthodontist sees, of course, do not all possess this mean pattern of potential growth. They are subject to differences of heredity and to the impact of environment.

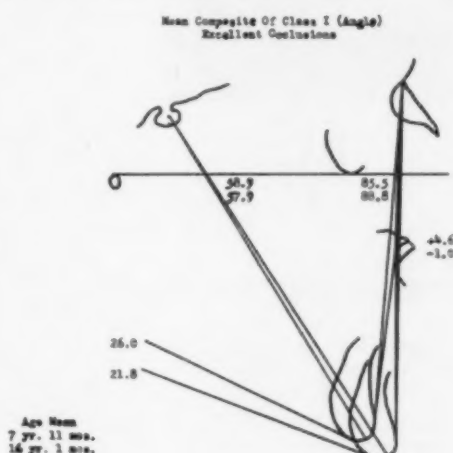


Fig. 10.

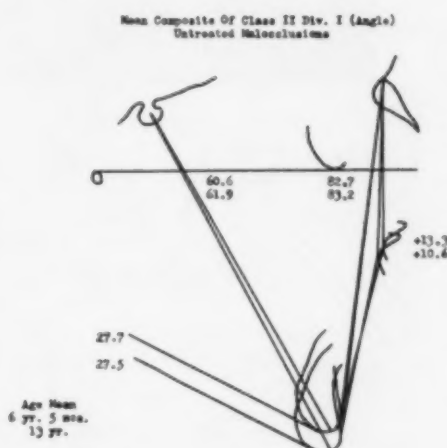


Fig. 11.

Fig. 10.—Mean composite of growth changes in normal occlusion. (From A. W. Moore.)

Fig. 11.—Mean composite of growth changes in Class II, Division 1 malocclusion. (From A. W. Moore.)

Some years ago Dr. Alton Moore¹⁵ while at the University of Illinois studied the growth changes of ten children with normal occlusions and ten with untreated Class II, Division 1 malocclusions while they were passing through the transitional stage of their dentitions. He found a significant difference in the unfolding of the developmental pattern of these two groups representing specific differences of occlusion, one group selected for excellence of occlusion, and the other representing one type of malocclusion. The important difference in the two patterns of growth is the behavior of the lower face or mandible.

In the normal occlusion group (Fig. 10) the facial angle has increased. The chin has moved forward faster than the maxilla with the consequent

straightening of the profile or, as we say cephalometrically, a reduction of the angle of convexity. The Y axis or growth axis has decreased, which may be interpreted as more horizontal than vertical growth having affected the position of the chin.

The Class II, Division 1 cases (Fig. 11) behaved differently, there was very little increase in the facial angle, a small reduction in the angle of convexity, and the Y axis increased, indicating an excess of vertical growth over horizontal growth. The figures on the diagrams are mean readings for the sample; the individual readings for each of the 20 cases of the facial angle and Y axis are shown in Fig. 12.

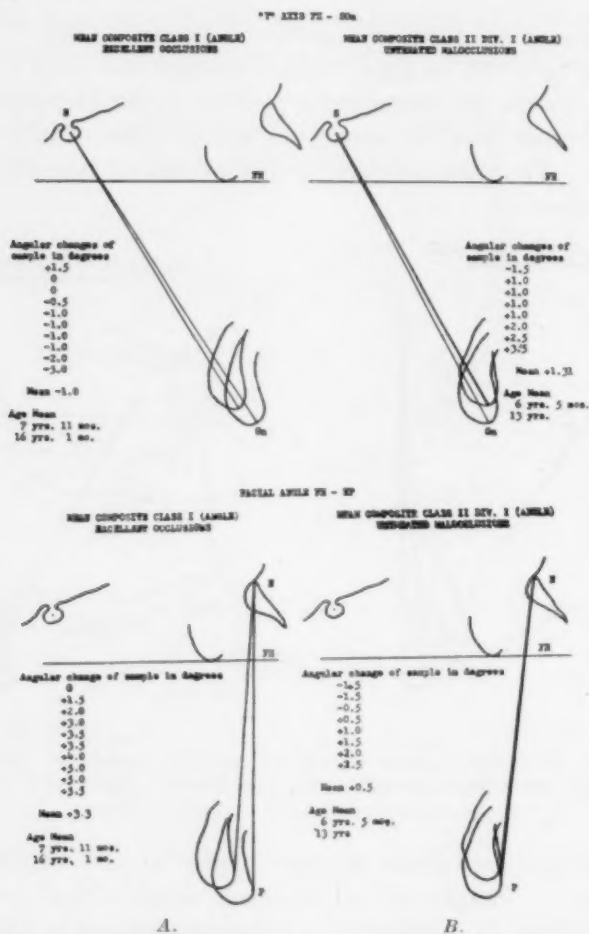


Fig. 12.—Individual changes in the facial angle and Y axis in the normal occlusion (A) and Class II, Division 1 cases (B). (From A. W. Moore.)

This work of Moore's, even though the sample was small, clearly indicates that growth and development has its variations the same as does size and proportions of the face. Of course, there is nothing new in this observation, but neither is it to be taken lightly as unimportant to our problems. Often it spells the difference between success or failure in our efforts at treatment. This can be more graphically illustrated by selecting extreme deviations from the mean pattern of growth.

The following three cases represent the static and dynamic cephalometric analysis of a successfully treated case and two unsuccessfully treated cases. None of these cases were involved in abnormal mandibular movements.

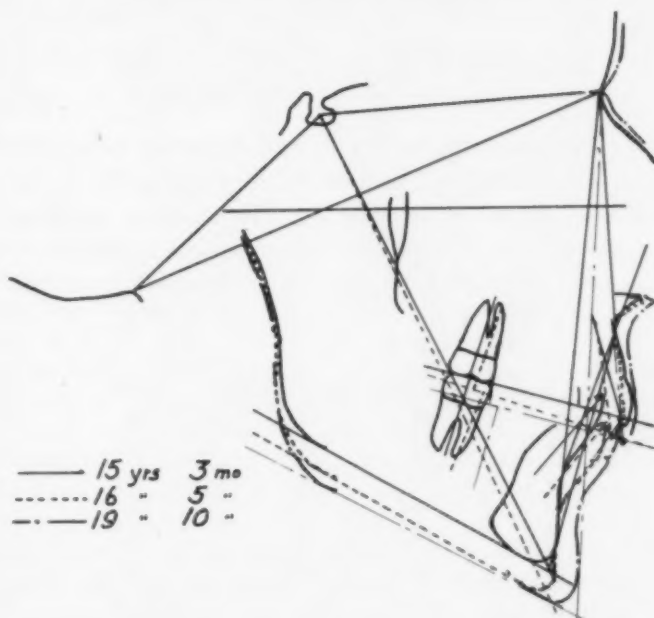


Fig. 13.—Case 1.

Case 1.—(Fig. 13.) Lateral views of the models before treatment, at the time of retention, and two and one-half years after removal of the lower retention are shown in Fig. 13. No maxillary retention was used. There were no complications of inadequate arch length or badly rotated teeth. The photographs show a forward position of the upper face and good muscle balance.

The x-ray tracing indicates that the fullness of the face is due to a forward position of the maxilla resulting in a high degree of facial convexity. The principal skeletal change at the time of retention was a downward and backward movement of gnathion. This has been caused by changes in the occlusal plane and the mandibular plane angle due to opening the bite through the influence of intermaxillary elastics and the unsettled condition of the inclined planes at the time of retention. The tracing two and one-half years after the removal of all appliances shows a return to the original pattern and the difference between the second and third skeletal patterns may now be considered to be due to growth. It should be noted that the Y axes of the first and last tracings coincide.

TABLE IV

CASE 1	15 YR., 3 MO.	16 YR., 4 MO.	17 YR., 9 MO.	MEAN	S.D.
Facial angle	85	85	86	88	3.5
Angle of convexity	+19	19.5	+16	0	5
AB plane	-15	-18	-12.5	-4.5	3.6
Mandibular plane	30	31	29.5	22	3.2
Y axis	63.5	65	64.5	59.5	3.8
Occlusal plane—FH	15	18	15.5	+9.5	3.8
1 to 1	123	132	133	135.5	5.7
1 to occlusal plane	+25	+21	+22	+14.5	3.4
1 to mandibular plane	+7.5	+8.5	+9.5	+1.5	3.7
1 to AP	+9 mm.	+5 mm.	+5 mm.	+2.5	1.8

The cephalometric explanation of the static and dynamic analysis of this patient is given in Table IV. Note in the first column the good facial angle and very high angle of convexity. Compare the first column readings with the mean and standard deviations of the normal occlusion series for a static analysis, and with the second and third columns for a dynamic analysis.

TABLE V

CASE 2	10 YR., 8 MO.	14 YR., 2 MO.	17 YR., 9 MO.	MEAN	S.D.
Facial angle	75	76	76	88	3.5
Angle of convexity	+11	+11	+12	0	5
AB plane	-9	-10	-11	-4.5	3.6
Mandibular plane	45	46.5	47	22	3.2
Y axis	75	75.5	77	59.5	3.8
Occlusal plane—FH	25	22	22	+9.5	3.8
1 to 1	128	116	113	135.5	5.7
1 to occlusal plane	+12	+19	+23	+14.5	3.4
1 to mandibular plane	-8	-6	-2	+1.5	3.7
1 to AP	+10	+13	+14 mm.	+2.5	1.8

Case 2.—(Fig. 14.) This patient was referred to me at 10 years of age. Active treatment had been going on several months. The facial type was retrognathic and facial muscle balance was poor. The photographs do not represent

usual lip position. This is evident by their strain in the closed position. Treatment was continued for several months longer but progress was so poor that the appliance was removed to wait for eruption of teeth. The case relapsed rapidly. Treatment was not resumed because they, or I should say the boy, refused to accept the proposed plan of treatment. The models show the case at 10 years,

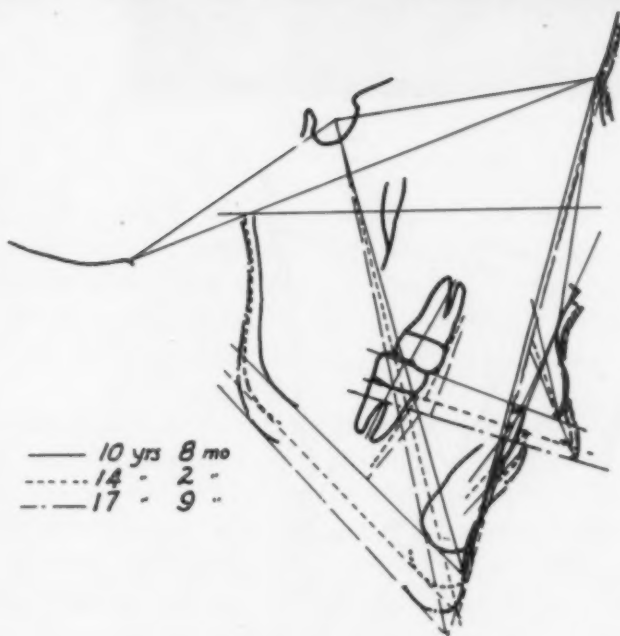
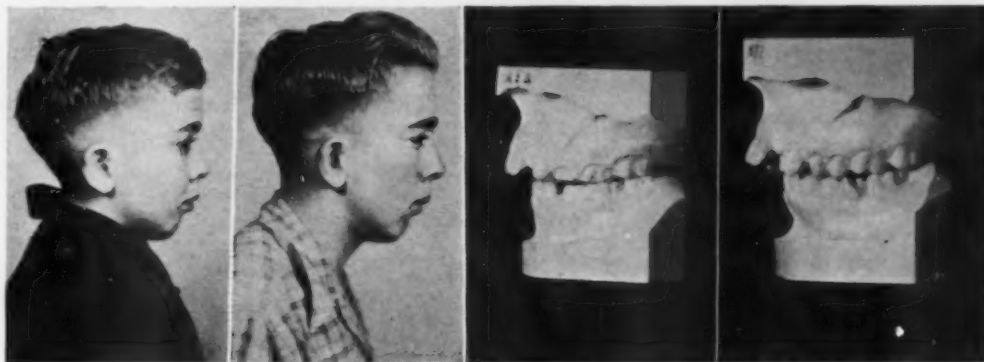


Fig. 14.—Case 2.

8 months, and seven years later. The tracings indicate the problem with which we are dealing; the disharmony of the skeletal and denture pattern is severe. The degree of disharmony is recorded in Table V and is particularly evident in the very low facial angle; this, coupled with the high Y axis, is indicative of a retrusive mandible.

Such a pattern holds little hope for a desirable growth prognosis.

Case 3.—(Fig. 15.) The last case did not seem to present too difficult a problem. The face is slightly concave for an 11-year-old child, but looked

much better at the time of retention and was still good two and one-half years later. The models show a Class I malocclusion with a good mandibular arch, a small maxillary arch, and some open-bite. The case treated well and in spite

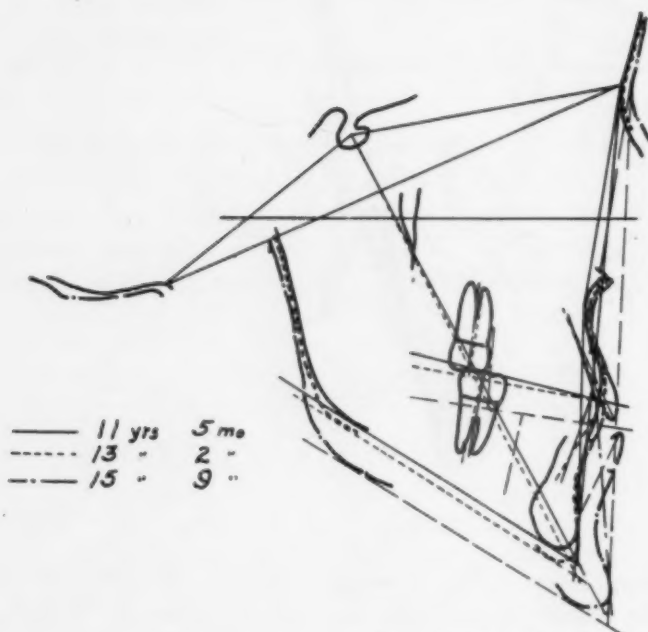


Fig. 15.—Case 3.

of the incomplete locking of the cuspid, it looked as though it should settle nicely. The last model showed what happened in the next two and one-half years. The tracings show a concave skeletal pattern, a fairly high mandibular plane angle, and a long mandible.

The balance and harmony of the skeletal and denture pattern were considered good at the time treatment was planned. They seemed to be even better at the time of retention. Something went wrong after the appliance was removed. The last tracing shows definite disharmony. It is interesting to follow the changes in this case with the cephalometric appraisal (Table VI).

Between the first and second readings the changes appeared quite favorable. The decrease in the facial angle and the increase in the Y axis and mandibular plane angle are usual findings when intraoral elastics have been used in treatment.

TABLE VI

CASE 3	11 YR., 5 MO.	13 YR., 2 MO.	15 YR., 9 MO.	MEAN	S.D.
Facial angle	85.5	84.5	88	88	3.5
Angle of convexity	-7.5	-6	-14	0	5
AB plane	+2	0	+9	-4.5	3.6
Mandibular plane	31.5	34	32	22	3.2
Y axis	62	64	62.5	59.5	3.8
Occlusal plane—FH	14	10	+8.5	+9.5	3.8
1 to 1	142.5	131	127.5	135.5	5.7
1 to occlusal plane	+4.5	+17.5	+16.5	+14.5	3.4
1 to mandibular plane	-13	-6.5	-6.5	+1.5	3.7
1 to AP	+3 mm.	+4.5	+4	+2.5	1.8

The changes in the facial angle and the angle of convexity between the second and third readings are high. This indicates considerable mandibular change but very little maxillary forward growth, thus increasing the antero-posterior discrepancy of the denture bases.

SUMMARY

Orthodontics is a problem of relationships within the dentofacial complex. The profile pattern has commanded the most attention, probably because it affects the appearance of an individual so much and is of major concern in orthodontic therapy. The cephalometric roentgenograph has provided a means of accurately appraising the relationships of the parts of the face leading to a description of the mean or average facial form of normal occlusion. It also shows the range of variation that may occur. These abilities permit the attempt to classify facial types. This method of study and description of the skeletal and denture patterns of an individual at any particular time has been described as a *Static Analysis*.

When comparisons are made of records taken of the same individual at different times, the result is a quantitative and qualitative interpretation of changes and may be called a *Dynamic Analysis*. It is evident that variations occur in the manner in which the face grows.

It is not presumed that cephalometrics will supplant other methods of analysis; rather it should be looked upon as an aid in understanding the others.

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MODEL ANALYSIS FOR TREATMENT PLANNING

A PORTION OF A SYMPOSIUM ON CASE ANALYSIS AND TREATMENT PLANNING

ASHLEY E. HOWES, D.D.S., NEW ROCHELLE, N. Y.

MODEL analysis for treatment planning includes two major requirements of equal importance. One is an assessment of the possibilities of tooth movement, and the other is a prognosis of denture stability after treatment. The two cannot, or should not, be separated except for the purpose of discussion. Teeth should not be moved if the possibility of their remaining in their new positions is slight. We must consider not only the tooth material and the amount of bone which supports it, but also all the environmental forces which are responsible for maintaining the teeth in their positions. We must consider the relationship of the teeth to their supporting bone or basal arches, and we must consider the relationship of the basal arches to each other and to the rest of the face. We must decide if there is sufficient bone to support the teeth in their proposed positions, or try to estimate whether further anteroposterior growth will create sufficient bone. We must decide whether the tooth movements are possible, basing our judgment upon clinical experience, and, finally, with our judgment based principally upon observation of treated cases over a long period of time, we must try to estimate the possibility of denture stability. The case is studied by means of impressions of the denture, models of the denture, sections of such models if necessary, radiographs of the teeth and jaws, profile radiographs, and, most important of all, an examination of the patient and other available members of the family. All this is elemental, serving only as a reminder that tooth positions, basal bone, skeletal pattern, and muscular forces must always be considered together in any treatment planning.

This presentation will be confined principally to the feasibility of tooth movements as indicated (1) by the size and form of the basal arches, (2) by the relationship of the teeth to those arches, and (3) by the interrelationship of those arches to each other.

I. THE SIZE AND FORM OF THE BASAL ARCHES

The term basal arch, as used in this paper, refers to the apical third of the alveolus and the bone which supports the alveolar processes above the maxillary teeth and below the mandibular teeth. In the mandible, the important area from a diagnostic point of view is the most constricted area of the alveolus, which is generally about 8 mm. below the gingival margin.

Fig. 1 shows three cases, two of them with deficient bases and one with a normal base. The three sets of models for each case can all be made from the original alginate impressions. The model bases are planed parallel to the occlusal plane. The vertically sectioned models are made by planing the

This was presented at the meeting of the American Association of Orthodontists, Louisville, Ky., April 23, 24, 25, and 26, 1951.

models through the cusps of the maxillary first premolars perpendicular to the occlusal plane. The models showing the maxillary basal arches are made by pouring the maxillary impressions just to the inner borders of the peripheral rims. The case on the left, although a Class II, Division 1 malocclusion, has normal basal arches, the maxillary arch being parabolic in form with no constriction about the first premolars. The basal arches of the case in the center are constricted in the premolar area. There is a general constriction or lack of lateral development in the basal arches of the case on the right.

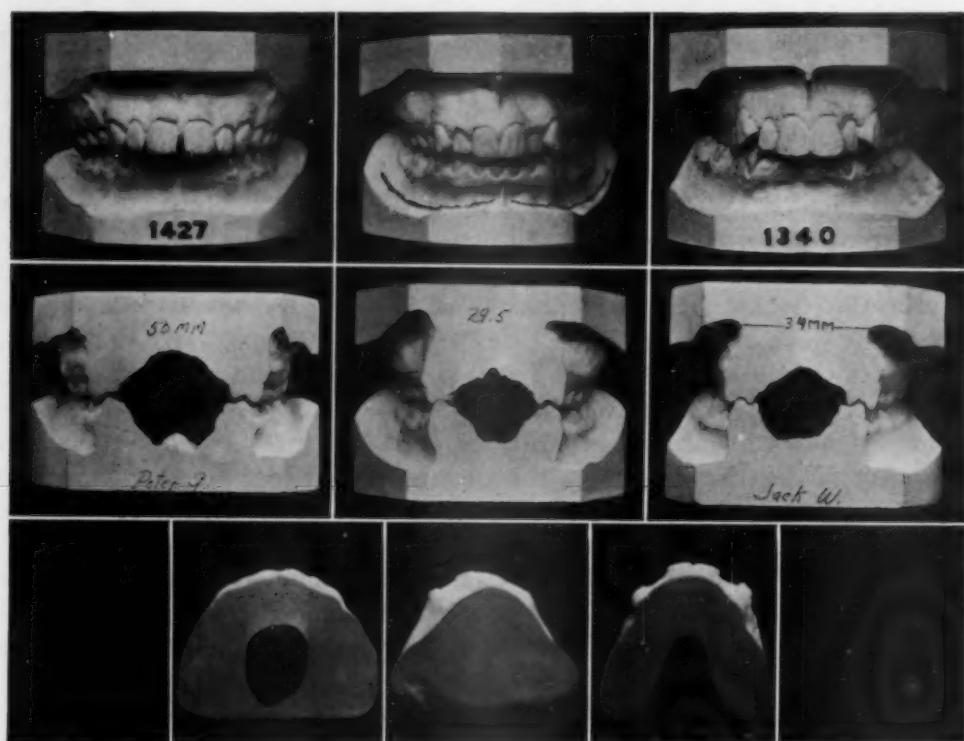


Fig. 1.—Left, Class II, Division 1 malocclusion with normal basal arches. Center, Class I case. Basal arches narrow in premolar areas, but not molar areas. Right, Class I case. General constriction of basal arches.

Since the beginning of orthodontics as a specialty, mechanical therapy has been employed to create space for crowded teeth and to change the antero-posterior relationship of the maxillary and mandibular teeth. Space has been created in three ways: by expansion of the dental arch, by lengthening of the dental arch, or by extraction of teeth.

When should we resort to one, when to another, when to a combination of any two, or all three? Expansion has often resulted in relapse; anteroposterior movement has often resulted in "the orthodontic look" if anterior teeth have been moved too far forward; or if the posterior teeth have been moved distally, the result has often been distal inclination or buccoversion of the second molars, or impaction of the third molars. Extraction has sometimes ended in spacing of the teeth or a retruded appearance in the dental area. Extraction certainly

provides a definite method of creating space. Is it being done too much by some and too little by others? How shall we plan our treatment? The answers are not contained in this paper, my hope being that it may contain some helpful hints.

In considering expansion as a treatment procedure, it has been pointed out in a previous paper that in normal occlusion there seems to be a rather definite correlation between tooth material and arch width in the maxillary first premolar region. Based upon the cases which I was able to measure, arch width in the maxillary first premolar region, measuring across the summits of the buccal cusps, should be at least 43 per cent of the total maxillary tooth material from first molar to first molar inclusive. The width of the basal arch above the apices of the first premolars should be slightly greater than the intercusp width, particularly if the measurements are made on vertically sectioned models which will measure at least 2 mm. more than similar measurements made in the mouth because of soft tissue. Whether or not this correlation of arch width to tooth material proves to be accurate when properly checked with sufficient anthropologic data remains to be seen, but it has proved of practical value in clinical practice.

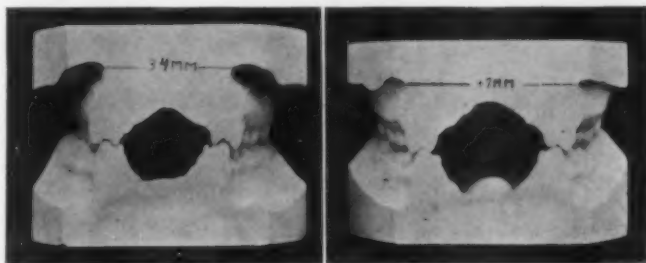


Fig. 2.—Left, Class I malocclusion. Basal arch above first premolars 34 mm.; 103 mm. of tooth material, maxillary first molar to first molar inclusive. Right, Normal occlusion. Basal arch above first premolars 47 mm.; 91 mm. of tooth material.

Fig. 2 contrasts vertical sections made through the first premolars of a normal occlusion and a severe malocclusion. The malocclusion with a basal arch width of 34 mm. (32 mm. in the mouth) has 103 mm. of first molar to first molar tooth material, while the normal occlusion, with a basal arch width of 47 mm., has 91 mm. of tooth material. The normal arch is one-half inch wider in the basal arch region, but has one-half inch less tooth material.* The case on the left should not be expanded in the premolar area.

Another assumption in considering expansion as a treatment procedure is that the basal arches cannot be expanded (in the first premolar area) after the eruption of the premolars, nor can we hope for any further natural lateral growth in this region. This does not appear to be true of the molar region, particularly of the mandible. The mandible continues to grow in width and length after maxillary growth is about complete. Just how much advantage orthodontic treatment can take of this growth is a subject requiring further

*Becoming familiar with the range of variation in tooth material is a diagnostic aid. A high percentage of the normal cases measured were in the low nineties measured in millimeters. High nineties and over one hundred often accompanied decisions to extract.

investigation. Swinehart reported a number of mixed dentition cases showing considerable expansion of the maxillary and mandibular dental arches when the tongue was given an opportunity to exert its proper influence. This coronal expansion was probably accompanied by increased lateral dimension of the mandibular basal arch. Early treatment has many intriguing aspects and much more investigation in regard to it will undoubtedly be carried on. In my own practice, expansion of the deciduous dental arches has produced a wide variation of final results.

In checking a number of models of deciduous dentitions, much less variation was found in the basal arch width above the first deciduous molars than was found in the basal arch width above the first premolars in the permanent dentitions. This could mean that there is an actual lateral contraction in this region following the loss of the deciduous molars.

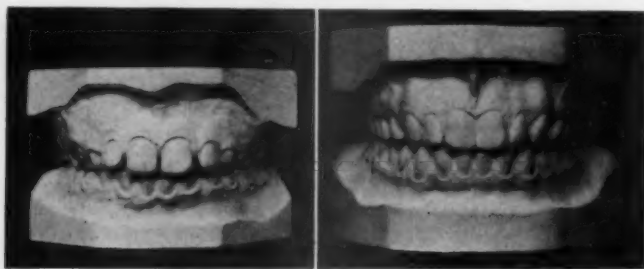


Fig. 3.—Models of mixed dentition, aged 8, and permanent dentition twenty-four years later.

Fig. 3 is an example of such a contraction, being a comparison of the models of a girl at the age of 8 and at the age of 32. Note the bulging of the bone above the deciduous teeth.

Surveys comparing these models are shown in Fig. 4. The solid line represents the basal arch outline of the permanent denture and the dotted line represents the basal arch outline of the deciduous denture. The basal arch outline of the mixed denture actually stands outside that of the permanent denture. This is probably due to a bulging of the labial plates to accommodate the unerupted cuspids and premolars. After the eruption of these teeth, there was an actual diminution in width in the region above the premolars. The arch has grown in length to accommodate the second molars. This was a case of normal growth and development resulting in a normal dentition.

Deficient lateral growth of the basal arches of the deciduous dentition could be due to inherited skeletal pattern, or it could possibly also be due to a perversion of muscular forces which divert the growth in another direction. If the deciduous coronal arches are narrow, as the permanent teeth erupt, they must appear either mesial to their proper anteroposterior positions, or be badly crowded, with some teeth blocked out of the arch. A vicious cycle is set up with the malpositioned teeth aggravating the perversion of muscular forces. This is a possible explanation to a previously made observation that many malocclusions with very large teeth have exceptionally narrow basal arch widths above the premolars.

Fig. 5 illustrates a case reported at a meeting of the American Society of Orthodontists in 1928. The deciduous arches were expanded and the intermaxillary tooth relations were altered by elastic force. Inasmuch as there was no further treatment after the removal of the appliances from the deciduous teeth, and the positions of the maxillary incisors had not been influenced by orthodontic force, it was believed that these models made at the age of 17 (Fig. 6) represented the final result. There was some crowding of the anterior teeth. The change that took place in the next sixteen years is shown in Fig. 7. The models were made when the patient was 33 years of age. One might speculate on what this dentition would have looked like if it had had no orthodontic treatment. This can hardly be called a relapse, meaning a return to a previously existing malocclusion, because the permanent incisors were not in these positions when they erupted. It is an entirely different malocclusion. The crowding of the maxillary incisors and further crowding of the mandibular incisors is apparently the result of anteroposterior collapse, rather than from lateral collapse of the arches, as will be shown later. Muscular pressure, poor bone structure, and bad mouth hygiene, which aided in interdental bone destruction, may have contributed to the foreshortening of the coronal arches, but the immediate cause was evidently an anteroposterior deficiency of the basal arches with insufficient room for the third molars. There has been more crowding of the mandibular teeth on the right side where there is an impacted third molar than on the left side where the third molar is congenitally missing.

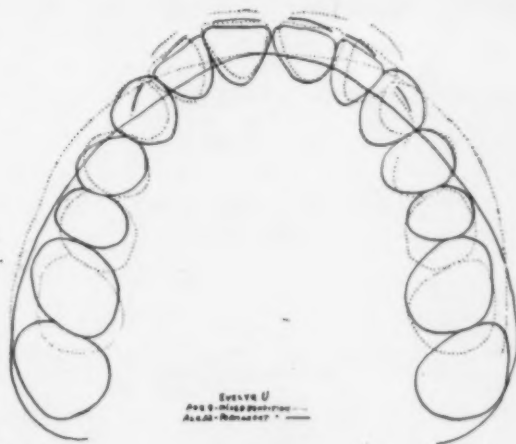


Fig. 4.—Comparison of maxillary dental and basal arches of mixed dentition, aged 8, and permanent dentition, aged 32.

The influence of erupting or impacted third molars on the positions of the other teeth has been a controversial subject for some time, but judging from clinical evidence, there is no question in my mind that the erupting force of mandibular third molars can produce considerable disturbance in the anterior teeth, if the basal arch is inadequate. Either the third molars should have been removed before the time of their eruption, or four premolars should have been extracted and the mandibular incisors properly aligned.

Fig. 8 shows a comparison of vertical sections through the first deciduous molars before expansion, age 6; and after expansion, age 8; and through the first premolars at age 17 and age 33. The deciduous arches show an increase of 8.5 mm. in the width of the maxillary coronal arch and a 4 mm. increase in



Fig. 5.—Front and occlusal views showing early expansion of deciduous dentition.

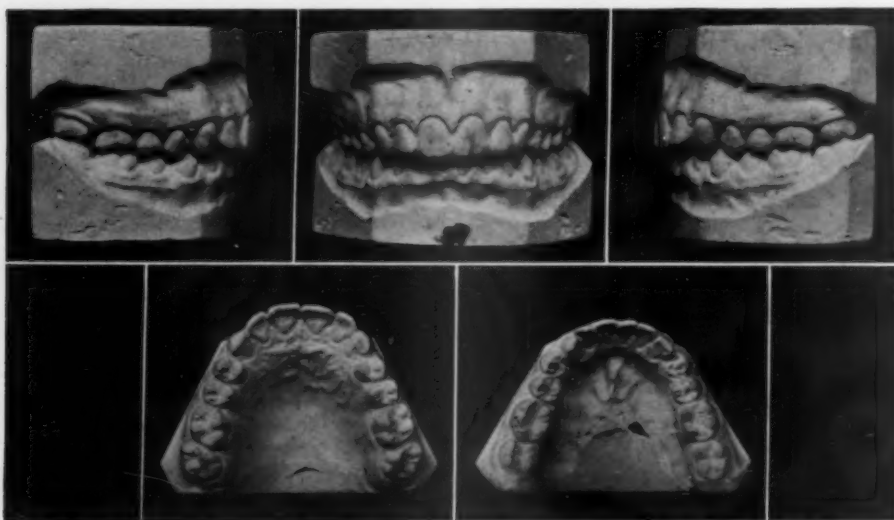


Fig. 6.—Permanent dentition of Case 97, aged 17.

the maxillary basal arch. There was a 9.5 increase in the mandibular coronal arch and a 9 mm. increase in the mandibular basal arch. But this increase was not maintained.

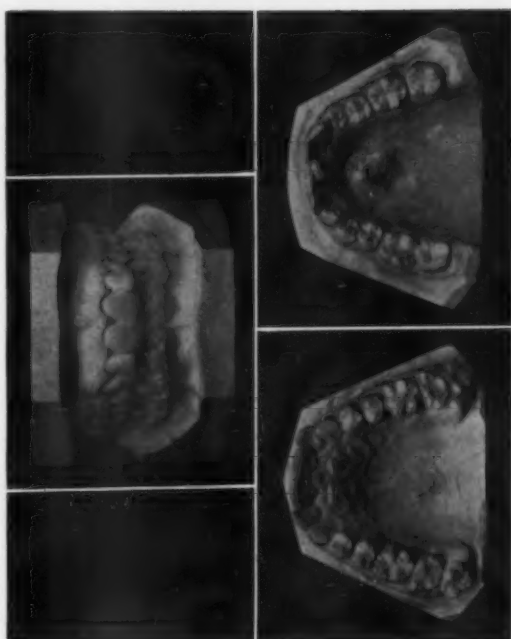


Fig. 7.—Dentition of Case 97, aged 33.

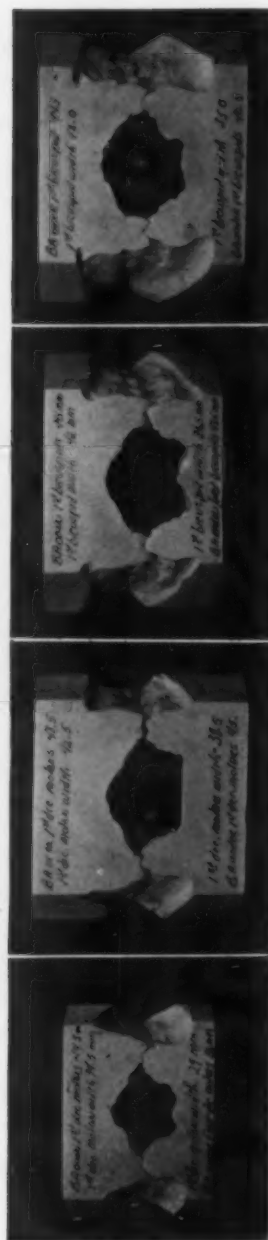


Fig. 8.—Case 97. Vertical sections through first deciduous molars before and after expansion and through first premolars, aged 17 and 33.

Although the coronal arches are 7.5 mm. wider, the maxillary basal arch width above the first premolars at 33 years of age is the same as it was above the first deciduous molars at the age of 6 before any orthodontic expansion. The increase in width above the deciduous molars following expansion has disappeared with the eruption of the premolars. However, even at the age of 6, and in spite of the constricted coronal arches, the basal arch width above the first deciduous molars was 45 mm., which was about sufficient to support a dental arch in the permanent dentition of normal width for its tooth material.

The mandibular basal arch, which apparently expanded in such a gratifying manner, has decreased 4.5 mm., which is about the same as the maxillary decrease. The increase in the mandibular measurement at the age of 33 over that at the age of 6 may be due to forward growth of the mandible rather than lateral growth. The section could have been made through a wider part of the mandible, as the mandible was distal in the original condition and in normal anteroposterior relationship at the age of 33.

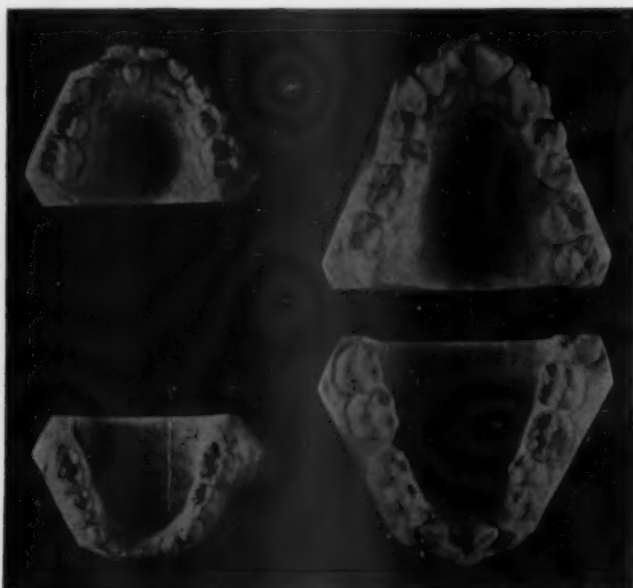


Fig. 9.—Lateral basal arch deficiency in untreated case, aged 5 and 30.

Fig. 9 is an example of insufficient lateral growth in the deciduous basal arches in an untreated case, and the resulting malocclusion of the permanent teeth twenty-five years later. The basal arches above the first deciduous molars and above the first premolars measure the same. It would be interesting to know what this adult occlusion would have been if the deciduous dental arches had been expanded, and if that expansion had produced or permitted a more normal balance of muscular forces. The question posed here is, "Can expansion of the coronal deciduous arches, if attended by a change in tongue action and a consequent rebalance of muscular forces, produce a wider basal arch to support the permanent dentition, or should expansion of the deciduous

dental arches be confined to those cases in which there is already sufficient basal arch width?" The answer to this question would have a great influence on treatment planning.

Turning now to expansion of the permanent arches as a treatment procedure, it is believed that the balance of muscular forces is responsible for the coronal or dental arch form of the permanent dentition. There is also a belief that the balance of these forces is immutable and, therefore, arch form should not be changed. Relapses, principally following expansion, have been

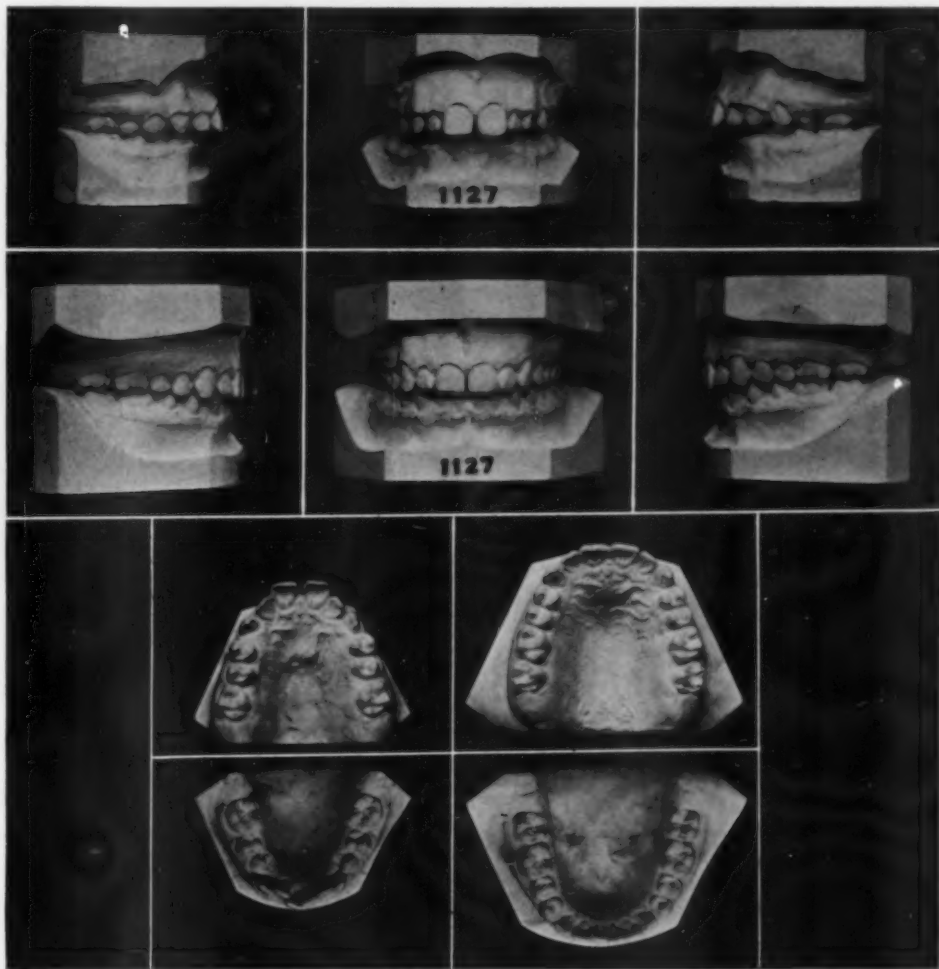


Fig. 10.—Case illustrating successful coronal expansion. Maxillary basal arch which was sufficient before expansion has remained the same. Mandibular basal arch has widened.

responsible for this conviction. We have all seen enough relapses following expansion to make us wary of it, but it is obvious that, just as relapse is evidence that a proper rebalance has not been achieved, stability in a case in which the dental arch form has been changed is evidence that a rebalance of muscular forces is possible. It is my opinion that such a rebalance of muscular forces can often be achieved in those cases in which the basal arch is sufficient

to support the expanded coronal arch. Fig. 10 illustrates such a case. Note the amount of expansion that has been obtained in the premolar and molar areas. The second set of models was made one year after the removal of all retention. There was considerable vertical growth, which cannot be seen in these models, but which may have encouraged a more favorable tongue position. Tongue position may be a major factor in the stability of this result. This case is not presented as a typical example of a result following expansion. It is probably more the exception than the rule, but that is no reason for regarding it as a freak case of no particular interest.

In our favor at the start of treatment, as orthographic projections of the case show, the maxillary basal arch is of sufficient width in the premolar area to support a dental arch of normal width for its tooth material. The premolars are well inside the basal arch outline. Furthermore, the basal arches are properly related to each other anteroposteriorly, the maxillary basal arch superposing the mandibular basal arch. There is one change in the mandible, which can be seen in the orthographic projections and also in the lingual views of the models (Fig. 11), which may be highly significant. The mandibular basal arch below the expanded first molars is considerably wider after treatment.

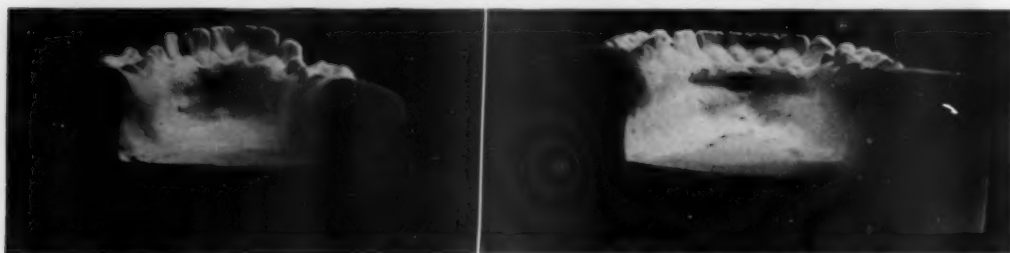


Fig. 11.—Lingual views of mandibular models showing lateral increase in both coronal and basal arches.

Another case demonstrating considerable expansion is shown in Fig. 12. Note the amount of expansion in the premolar area. A comparison of frontal sections through the first premolars of these models shows the expansion to better advantage. The dental arch width has been increased 6.5 mm. across the buccal cusps of the maxillary first premolars, and 6.5 mm. across the cusps of the mandibular first premolars. The maxillary and mandibular basal arch dimensions have remained practically unchanged in width in this premolar area. However, these arches were very wide originally, even for 100 mm. of first molar to first molar tooth material.

Note the lingual inclination of the premolars in the original model. This is an indication of basal arch width being greater than coronal arch width. For years orthodontists have realized that lingually inclined teeth could be tipped buccally with fair assurance of stability in their new positions. But there must be a new balance of muscular forces, and for that reason I believe in a long period of retention following such an expansion. This period of retention takes advantage of any further anteroposterior and vertical growth of the face and allows new patterns of muscular movements to be established.



Fig. 12.—Case requiring expansion of coronal arches in premolar area. Sufficient basal arch width.

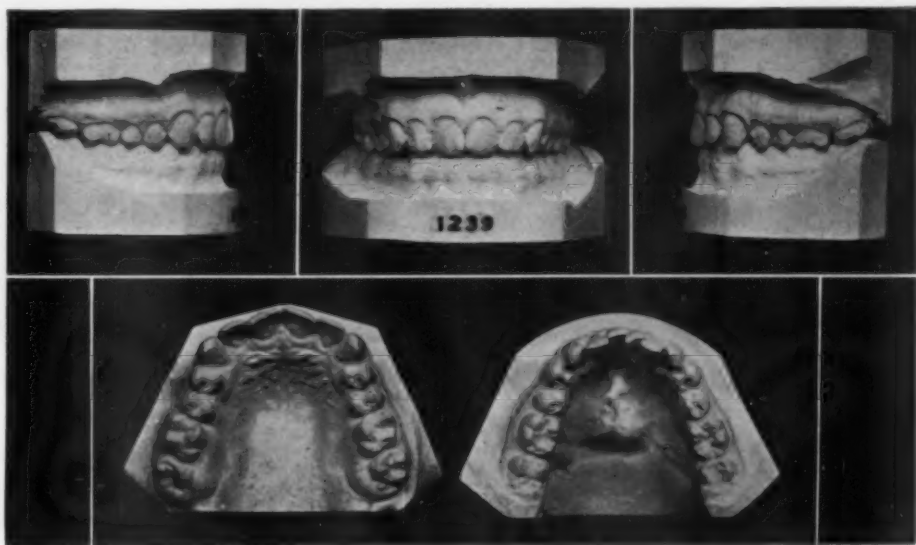


Fig. 13.—Relapse which occurred after treatment in Case 1239. Note distal inclinations of maxillary second molars.

Through lack of patient cooperation this case was retained for only a month after the appliances were removed, and the relapse which occurred two years later is shown in Fig. 13. Perhaps less relapse would have occurred if extra-oral anchorage had been employed in treatment to minimize the mesial movement of the mandibular buccal teeth caused by the forward pull of inter-maxillary elastics. But even with the irregularity of the mandibular incisors, the patient has a presentable and serviceable denture. Had premolars been extracted in this case, facial balance and the axial inclinations of the incisors and premolars would still call for buccal or labial tipping of the crowns, not lingual tipping of the roots.

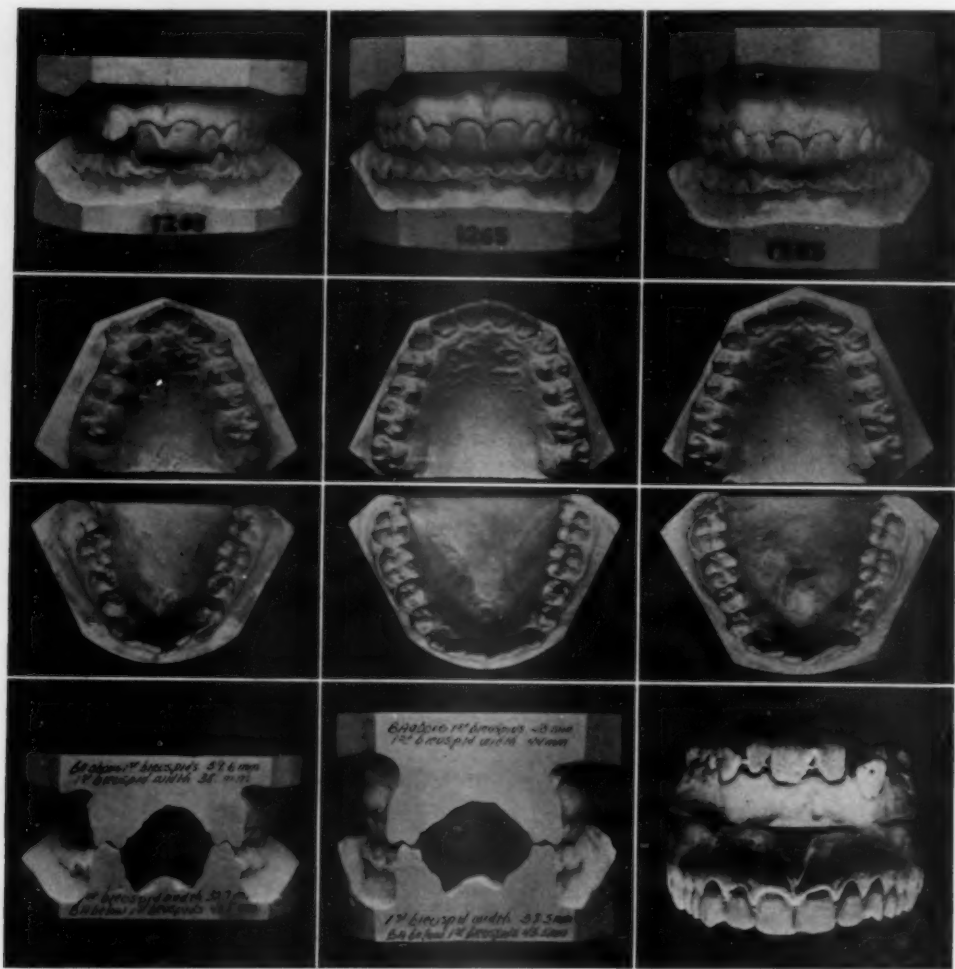


Fig. 14.—Coronal expansion with insufficient basal arch support. Teeth are tipped buccally. No change in maxillary basal arch.

Case 1265 (Fig. 14) is an example of when not to expand as a treatment procedure. The coronal arches were expanded several millimeters. The maxillary basal arch, as can be seen more clearly in the vertical sections, was much too narrow to support properly a dental arch of sufficient width to contain its

tooth material. This treatment was done during the era when I still had hopes that further lateral growth, catching-up growth as it were, would take place in the supporting bone during the retention period.

The vertically sectioned models, made through the first premolars of the original models and the models made eight years later, show no change in the lateral dimensions of the maxillary and mandibular basal arches. The premolars have been tipped labially into axial inclinations of functional disadvantage. If these teeth had been moved bodily, the maxillary roots would have penetrated the labial plates. The second models were made about a year after the retaining appliances, which had been worn nightly for nearly four years, had been discarded. In most instances I think we can depend on the muscles to help correct our errors, and there may be a gradual narrowing in the premolar area in this case, although I doubt if there will be much further change. In this case, if it remains as it is, a rebalance of muscular forces which maintains the widened coronal arch, even though the teeth have been tipped off their foundation, must have been established. Many such treatments illustrate our literature.

In Fig. 14, lower right side, I have attempted to compare the maxillary basal arches at 12 and at 20 years of age. Of course, the right side of one model superposes the left side of the other. The comparison could be made much better by orthographic projections or by radiographs of the models, as done by Richetts at the University of Illinois. However, this model gives an idea of the lack of change in the maxillary basal arch area and does show the surprising bilateral symmetry which exists in the basal arch, even when accompanied by severe malocclusion.

Summing up the possibilities of expansion as a treatment procedure: Expansion should not be used when the basal arches are deficient in width or when buccal teeth are positioned mesially to such an extent that their distal movement is not feasible. Expansion will not eliminate the necessity for extraction when the basal arches are deficient anteroposteriorly, even if they are laterally sufficient.

Expansion can and should be used when the basal arch width above the first deciduous molars in the deciduous dentition or above the first premolars in the permanent dentition exceeds the coronal arch width sufficiently to support a coronal arch of normal width for its tooth material, with the teeth in normal axial inclination. The basal arch width should be at least 44 per cent of the maxillary tooth material from first molar to first molar inclusive. It can be somewhat less than this if some irregularity of the anterior teeth is acceptable. The expanded arches should be maintained by retention until further vertical and anteroposterior growth of the face and a rebalance of muscular forces takes place. This should be encouraged by muscle training when possible.

II. THE RELATIONSHIP OF THE TEETH TO THE ARCHES

The second treatment procedure to be considered is the distal movement of maxillary posterior teeth. It is unnecessary to state that distal movement

is often used in conjunction with expansion. As maxillary buccal teeth are moved distally into a wider part of the arch, they move further apart laterally. Research investigators and clinicians seem to differ in their opinions concerning the possibility of orthodontic distal movement of teeth. Research findings indicate there is little actual distal movement of posterior teeth when such a movement is attempted, while the clinicians, pointing to the spaces created for blocked-out teeth, claim that the movements are obvious. It seems to me that this is not a real controversy, because the contention of the former is generally based on cephalometric radiographs, which often indicate that the forward growth of the face kept pace with the distal movement of the teeth, so that the teeth did not move distally in relation to some reference point in the skull. However, there undoubtedly was distal movement of the teeth in relation to their immediate supporting bone, which is what the clinicians refer to. This distal movement is generally a tipping movement. I doubt if much bodily movement can be accomplished unless space has been created by extraction. Distal tipping is not always evident in models made before and after treatment, because the cant of the occlusal plane has been made steeper during treatment. Therefore, when models of the case before and after treatment are planed parallel to this occlusal plane, the axial inclinations of the posterior teeth appear about the same in both models, creating the illusion that the teeth have been moved bodily distally. Accurate gnathostatic models will indicate the change in the cant of the occlusal plane* and changes in the inclinations of the teeth. It can also be seen in the profile radiographs.

Brodie and others have called attention to the increase in the angle which the occlusal plane makes with the Frankfort horizontal plane as a result of intermaxillary force in the treatment of distoclusion. Brodie says that the plane tends to return to its original cant after retention is discontinued, which might be one of the reasons why the mandibular incisors often become gradually more crowded after Class II intermaxillary elastics have been employed.

Distal movement of maxillary buccal teeth is particularly indicated when the mesial positions of these teeth is not due to a constricted or foreshortened basal arch. Such a condition could be caused by premature loss of deciduous teeth. When the basal arch is sufficient in width, but somewhat deficient in length, we might assume that lack of timing in growth and tooth eruption has caused mesial positioning of the premolar and cuspids. Later growth may enlarge the basal arch anteroposteriorly, but in my experience it is unwise to anticipate very much of this growth. We cannot depend on future anteroposterior growth to upright second molars which have been excessively tipped distally by orthodontic force, although slight distal tipping of these teeth may be so corrected. Dental age is an important factor in appraising the possibilities of distal movement.

*If the cant of the occlusal plane has been increased by orthodontic forces, a change in the anteroposterior relationship of the maxillary and mandibular basal arches will be indicated in the orthographic projections which will not be substantiated in the profile radiographs. In other words, the actual change has not been a shift in the anteroposterior relationship of the maxillary and mandibular basal arches as indicated by the survey, but has been a change in the cant of the occlusal plane. This should be borne in mind when using orthographic projections.

An ideal case for distal movement of the maxillary buccal segments is illustrated in Fig. 15. The basal arches are well developed, both laterally and anteroposteriorly. It is a Class II case, that is, the mandibular basal arch is situated distally to the maxillary basal arch. The chin is prominent with the mandibular alveolus set well back from it, as is often true in Class II, Division 2 cases.

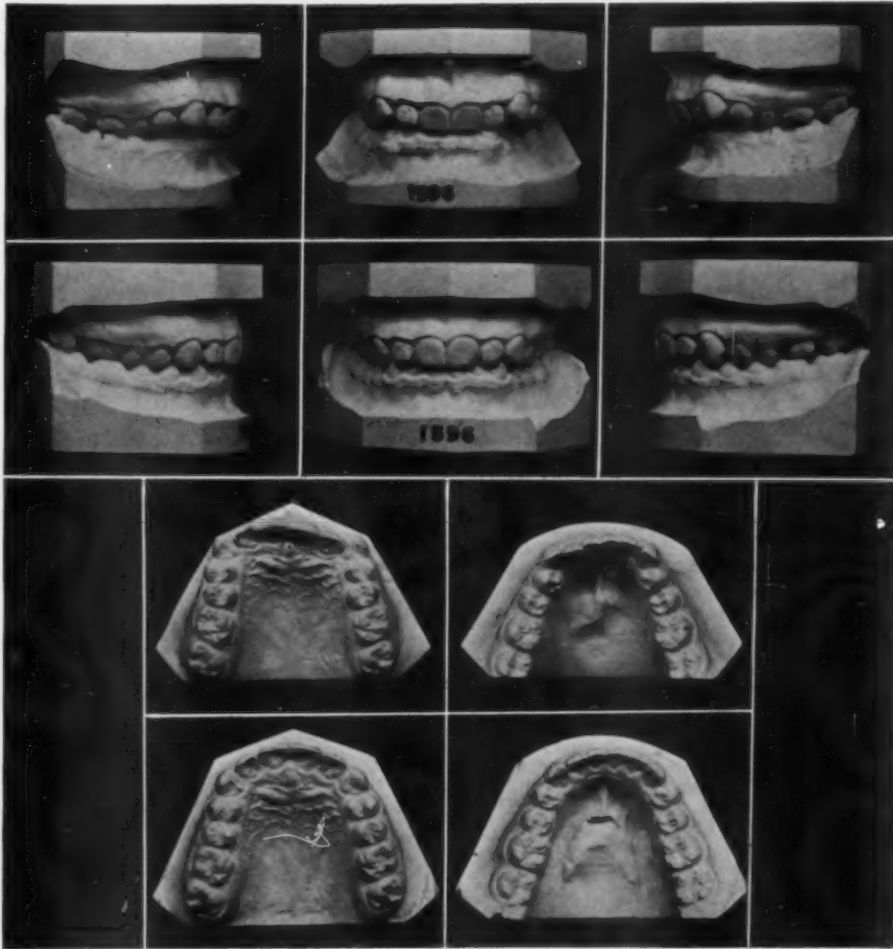


Fig. 15.—Ideal case for distal movement of maxillary buccal segments.

The treatment was rather simple, moving the maxillary buccal segments distally as individual units. Light intermaxillary elastic force was used, depending on the lingually inclined maxillary and mandibular incisors, and the firm lip pressure which attends these lingual inclinations, to afford good anchorage for this movement. As the buccal segments moved distally, the maxillary incisors tipped labially, the mandibular incisors tipped labially, and the whole mandible either moved forward or grew forward 2 mm. The overbite decreased in a very satisfactory manner.

A comparison of the profile radiographs before and after treatment (Fig. 16) points out these changes and also points out what an obvious mistake it would be to extract teeth in a case like this. The facial angle has increased or opened, indicating that the whole mandible has moved or grown forward. Before and after treatment radiographs with the mandible in rest position, as pointed out by Thompson, would help to differentiate between growth and forward movement. It can also be clinically established whether or not cuspal interference is forcing the mandible distally when the teeth are in occlusion. This case at the beginning of treatment was in distal relationship in both rest position and occlusion, and therefore the change must have been due to mandibular growth. The anterior teeth, even after they have been tipped forward, still fall inside the facial plane. Because of the prominent chin point, the face is recessive in the dental area. Note the vertical position of the unerupted third molars below the level of the floor of the nose, an indication of sufficient maxillary length permitting distal movement of the maxillary buccal teeth. Another indication of sufficient maxillary length is correct axial inclinations of the second molars with little distal and no buccal tipping.

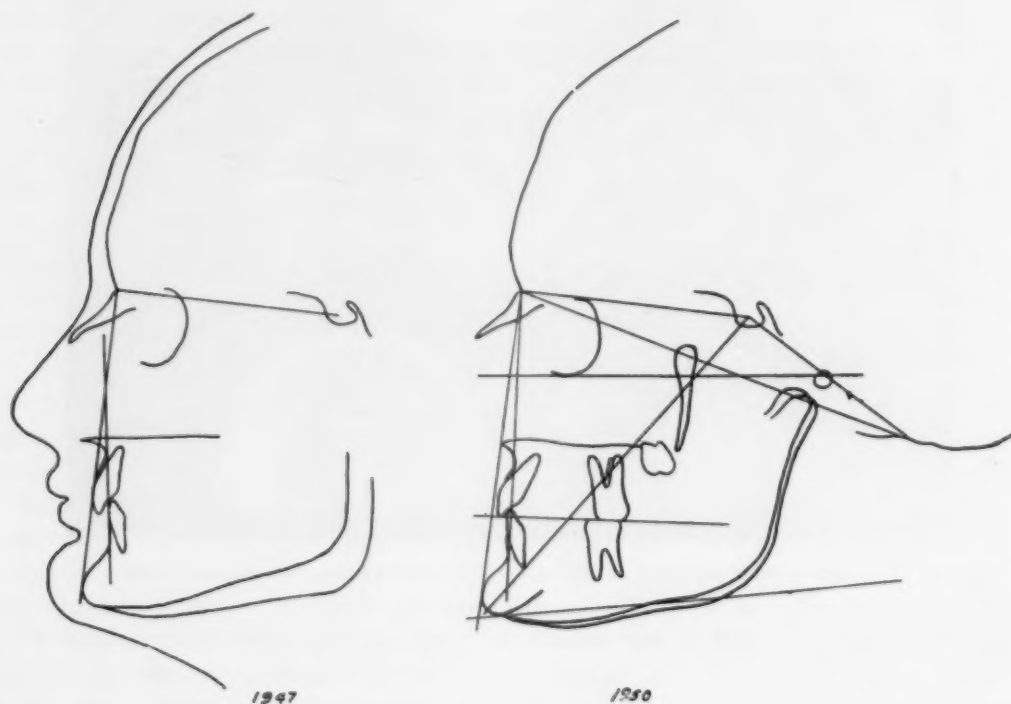


Fig. 16.—Tracings of profile radiographs of Case 1596 before and after treatment.

The removal of the maxillary second molars in selected cases facilitates the distal movement of the premolars and first molars. If such a procedure is followed, care must be exercised to prevent the extrusion of the mandibular second molars until the maxillary third molars erupt and have taken the place

of the second molars. Second molars should never be extracted unless well-developed maxillary third molars are shown in the radiographs, and unless the maxillary basal arch is normal in width.

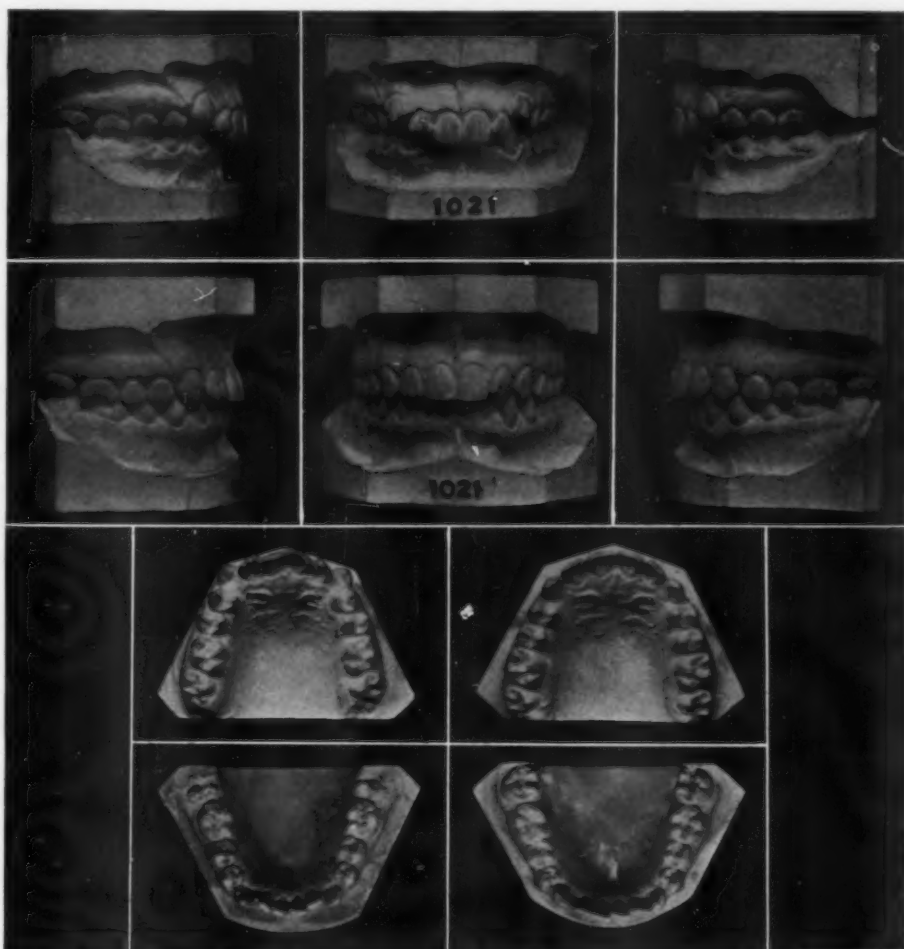


Fig. 17.—Extraction of maxillary second molars to facilitate distal movement of maxillary first molars and premolars. Second model made after eruption of maxillary third molars.

Fig. 17 illustrates a case in which the maxillary second molars were extracted. The maxillary buccal teeth were moved distally by light intermaxillary elastics which were worn less than three months. Because of the crowded condition of the mandibular incisors, if treated today, I would use extraoral anchorage in conjunction with light intermaxillary force. However, the mandibular anterior teeth in the second model, which was made about two years after retention was discarded, are no more and are possibly less irregular than they were in the original model. Note the positions of the maxillary third molars.

Dr. Joseph Johnson, in the treatment of distoclusion, makes excellent use of distal movement of the maxillary posterior teeth. He moves them back into

a proper mesiodistal fit with the mandibular teeth, or even beyond a mesiodistal fit to allow for some relapse. Having obtained this proper tooth relationship, the face can continue its downward and forward growth, thus developing in a more normal manner during and after the period of retention.

Summing up distal movement as a treatment procedure: It can be used in the maxillary arch if the basal arches are sufficient in width and length and if the mandibular buccal teeth are not forward of their normal positions. To accomplish the movement, extraoral force should be used if possible. If intermaxillary force is used, it should be kept to a minimum.

The third possibility and the one which should rightfully be considered last, because it is a last resort, is extraction. If expansion, distal movement, or a combination of the two are ruled out as unfeasible, we must decide whether to leave the case untreated or to extract teeth. If there is a good functional occlusion with the mandible in centric relation when the teeth are occluded, if there is some overlapping of the anterior teeth, and if this irregularity is not particularly disfiguring and does not create a psychological disturbance in the mind of the patient or the parents, then it is my opinion that extraction and treatment are contraindicated. A high susceptibility to caries could alter this opinion. In the type of case described, the basal arch is generally slightly deficient or the posterior teeth are all slightly forward of their normal positions, with the anterior teeth crowded but not inclined labially. In most cases requiring extraction, the basal arches are deficient laterally or anteroposteriorly or both. However, it is quite possible for severe malocclusion requiring extraction to occur with normal lateral basal arch dimension. This type of malocclusion could be due to lack of timing in growth and tooth eruption or premature loss of deciduous teeth, or a combination of these two factors. The maxillary and mandibular buccal teeth erupt so far forward of their normal positions that it is impossible to move them far enough distally to create enough space for the crowded anterior teeth and the blocked-out cuspids. Removal of four premolars in this type of case produces good results because good arch form and facial balance can be achieved.

Premolar extraction seems to be the most logical solution to the problem of anteroposterior basal arch deficiency for it allows the maxillary second and third molars, which are generally tipped distally or buccally or both, to swing down into a more vertical location as the first molars move forward. The unerupted mandibular third molars, which generally have an excessive mesial inclination, swing upward into a more vertical position as more space is provided for them. Distal movement of the first molars has just the opposite effect on the teeth behind them and should be avoided when the basal arches are deficient anteroposteriorly. The great disadvantage of premolar extraction, as Brodie has pointed out, is that it often creates more space than we need.

Whenever premolars are extracted, the incisors can be moved around the arch distally, and they can be tipped inward if such movement is called for, but once the incisors are vertical, they cannot be moved any further inward and all the residual spaces must be closed by forward movement of the teeth

distal to the spaces. This is a good thing to bear in mind when only 2 or 3 mm. of space are needed to smooth out the incisors and extraction is being considered. Residual spaces in the final result of the extraction case are likely to occur if normal basal arch dimensions existed at the start of treatment.

A word about protrusion. I think of protrusion of the incisors as that condition in which the incisal edges extend excessively beyond the basal arch outline. This can occur in either arch, in either neutroclusion, distoclusion, or even mesioclusion. When it occurs in both arches, it is called bimaxillary protrusion of the teeth.

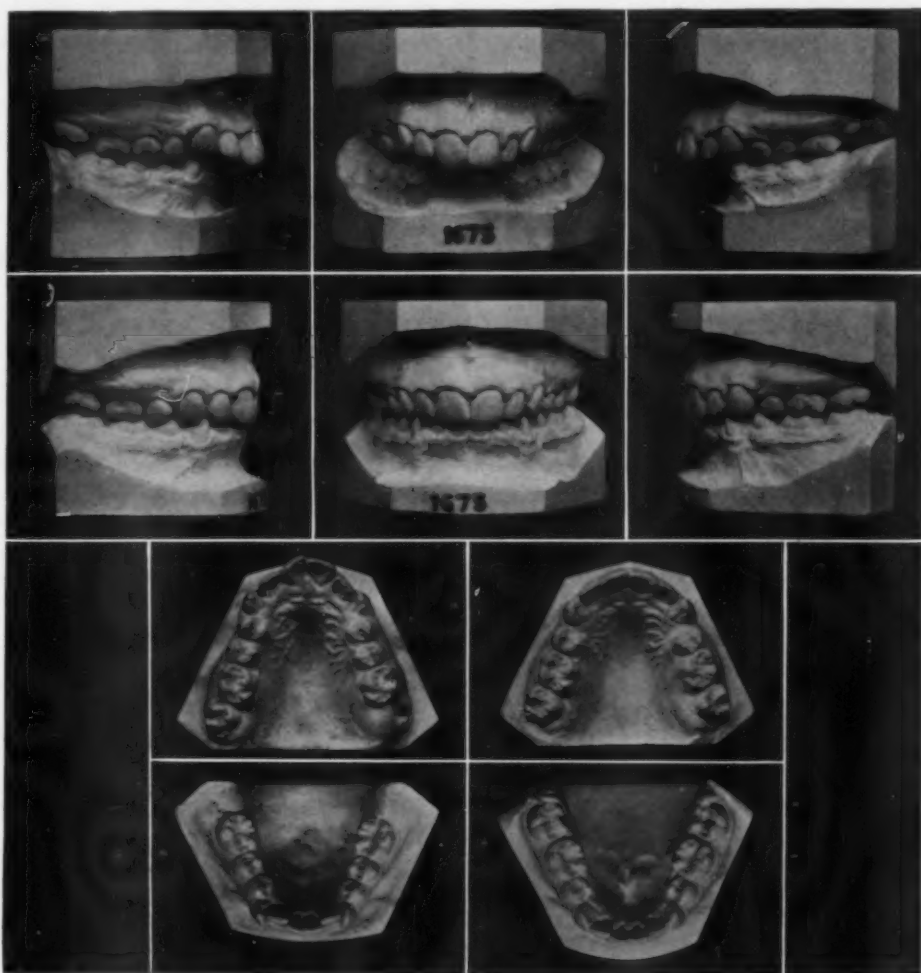


Fig. 18.—Basal arches deficient in both length and width. Mandibular basal arch distal to maxillary basal arch in original condition, but not after treatment.

Such protrusion must be due to a lack of normal lip pressure, for if lip pressure were normal even with deficient basal arches, the anterior teeth would be crowded or blocked out rather than protruding. Therefore, if such protrusion is to be corrected by tipping the anterior teeth lingually after the cuspids have been moved distally into the spaces created by extractions, myo-

functional therapy is definitely indicated to build up normal lip pressure. Otherwise, we may end up minus four teeth, but with the anterior teeth almost where they were before treatment.

Fig. 18 illustrates a case in which the extraction of four premolars is indicated because the maxillary basal arch is only 39 mm. wide above the first premolars and the 100 mm. of tooth material calls for a width of at least 46 mm. when measured on a model. Furthermore, in the original condition, the second molars are tipped distally, which would contraindicate extensive distal movement even if lateral deficiency were disregarded. It is a case of true Class II distoclusion with the mandibular basal arch distal to the maxillary arch, but with the mandibular buccal teeth mesially positioned in relation to their supporting bone. This condition would be aggravated by the use of intermaxillary elastics. The objectives of treatment in this case, having accepted the compromise of extracting four first premolars, were: to retract the maxillary anterior teeth and cuspids, to retract the mandibular cuspids, and to hope for some further mandibular growth which would help correct the distoclusion. Without such further growth the mesiodistal malrelationship of the buccal teeth could only be corrected by changing the axial angles of the teeth and by forward movement of the mandibular second premolars and first molars. The models leveled on the occlusal plane show the result obtained. The axial inclinations of the incisors and the change in the maxillo-mandibular basal arch relationship are indicated in relation to the occlusal plane, but cephalometric profile radiographs before and after treatment would be necessary to see if the latter is due to a change in the cant of the occlusal plane or a change in the relative positions of Downs A and B points.

III. THE INTERRELATIONSHIP OF THE MAXILLARY AND MANDIBULAR ARCHES TO EACH OTHER

The final consideration in case analysis and treatment planning, the interrelations of the maxillary and mandibular basal arches, will be briefly described here in order to orient the models to the cephalometric radiographs which Dr. Downs has discussed.

Broadbent, Brodie, Thompson, Downs, Wylie, Margolis, Higley, Fischer, and many other writers have pointed out a number of conditions classified as distoclusion. Fischer has described five different types of so-called Class II, Division 1. We are told by various writers that Class II mesiodistal malrelationship could be due to an overlong cranial base, an overlong maxilla, forward positioning of the maxillary teeth, distal positions of the condyles in the glenoid cavities, a short mandible, a well-developed mandible with the alveolus placed too far distally, abnormal angles of the necks of the condyles, or abnormal gonial angles. Profile radiographs, when analyzed as Downs has described, are most helpful in arriving at a prognosis for treatment. Wylie's quantitative measurements are also useful. But I think Angle's classification can be applied very well to basal arch relationships when we are considering models of the denture.

Schematic drawings of the various classifications are shown in Fig. 19. In Class I, the maxillary and mandibular basal arches superpose. In Class II, the mandibular basal arch is distal to the maxillary basal arch, and in Class III, the mandibular basal arch is forward of the maxillary basal arch. This is not the same as neutroclusion, distocclusion, or mesiocclusion, because the occlusal relationships of the teeth might vary in all these three classes. For instance, as in the Class I case illustrated, distocclusion can exist when the maxillary and mandibular basal arches have a normal anteroposterior relationship. Just the teeth within the alveoli are improperly related. The maxillary teeth are forward of their proper positions. This could be thought of as a Class I distocclusion. The reverse is also possible as shown in the Class II case illustrated. The mandibular teeth on a distally situated basal arch can be so far forward of their correct positions in relation to their own basal support that they obtain a correct mesiodistal relationship with their maxillary opponents.

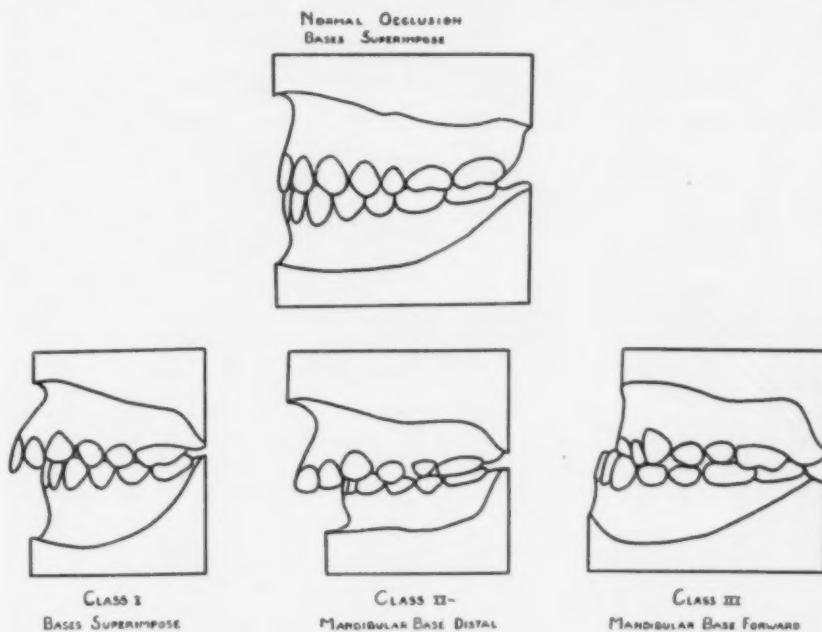
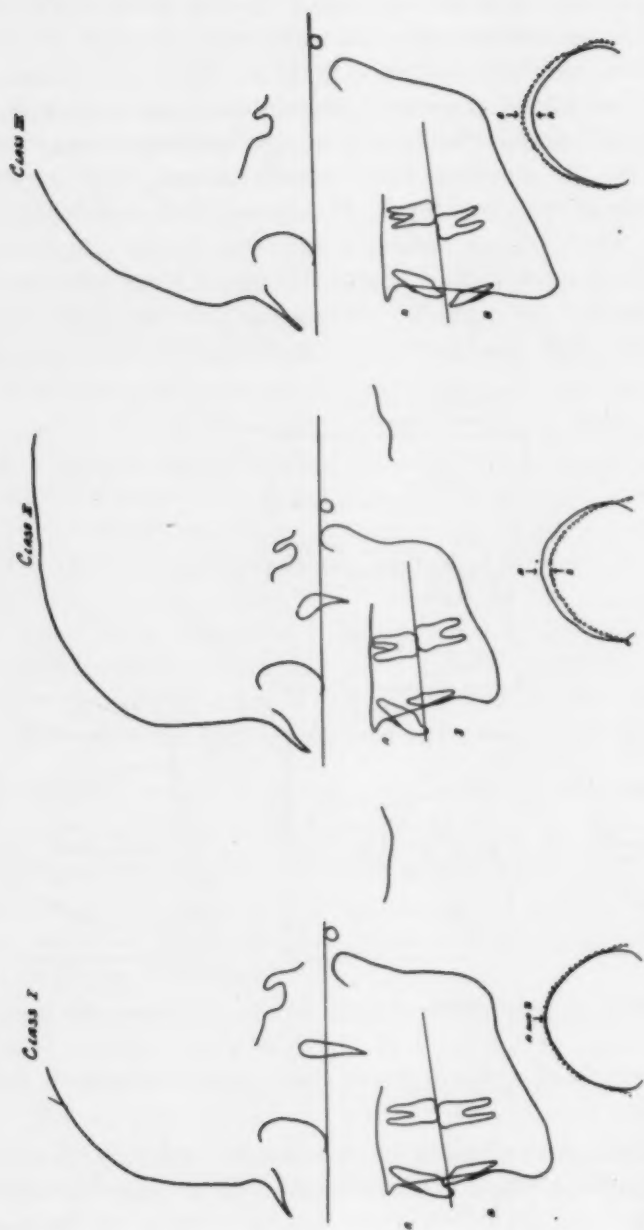


Fig. 19.—Schematic drawings of normal occlusion (top), Class I malocclusion (left), Class II (center), and Class III (right).

This could be thought of as Class II neutroclusion. Angle's Class II, Division 1 and Division 2 are both Class II distocclusion. In a Class III relationship of the basal arches, the mandibular incisors can be anterior to the maxillary incisors or they can be lingually inclined or the maxillary incisors can be labially inclined so as to achieve a normal anteroposterior relationship of the incisal edges. This is generally the end result of orthodontic treatment of a true Class III case.

The profile tracings shown in Fig. 20 demonstrate the three classifications and orient the horizontal projections with the vertical. Beneath the



See - *Handbook of Dental X-ray*
 See - *Handbook of Dental X-ray*

Fig. 20.—Profile tracings of Class I, Class II, and Class III malocclusions. In Class I a line connecting Downs A and B points is perpendicular to the occlusal plane. In Class II B is posterior to A. In Class III B is anterior to A.

profile tracings of the three classifications are the horizontal projections of the maxillary and mandibular basal arches with the models leveled on the occlusal plane. Downs A point in the profile tracing is the vertex or most anterior point of the horizontal maxillary basal arch, and Downs B point is the vertex or most anterior point of the mandibular arch. In the profile tracing of the Class I case, A and B are on a line perpendicular to the occlusal plane, in the Class II case, B is distal or posterior to A, and in the Class III case, B is mesial or anterior to A. It goes without saying that when we consider changing the interrelations of these two points we must think in terms of changing the interrelations of the entire basal arches.

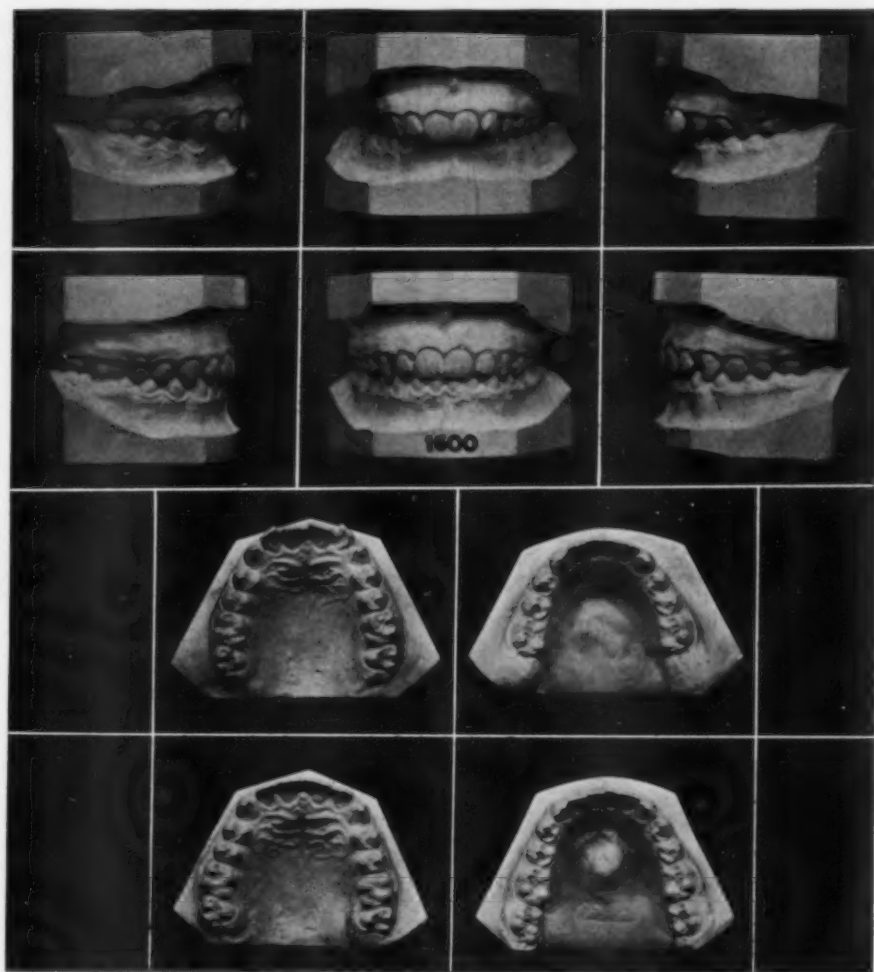


Fig. 21.—Correction of Class II case. Mandibular basal arch, which was posterior to maxillary basal arch in original condition, is directly below it after treatment.

The most important thing to try to decide in any malrelationship of the maxillary and mandibular arches is the true centric relation of the mandible, because occlusal interference may be causing an anteroposterior, lateral, or rotated displacement of the mandible. In any one of the three classifications,

there may be an eccentric position of the mandible when the teeth articulate. In a distoclusion case in which the mandible is being held distally by occlusal interference, as pointed out by Thompson, the prognosis is good, as the mandible can slide forward when the interferences are removed. But in those cases in which the mandibular basal arch is distal to the maxillary basal arch, the mandible not being forced back by occlusal interference, it seems to me that our only hope is additional growth of the mandible in excess of maxillary growth. Without this growth, distal movement of the maxillary teeth or forward movement of the mandibular teeth will change the interrelationship of the teeth, but not the interrelationship of the basal arches.

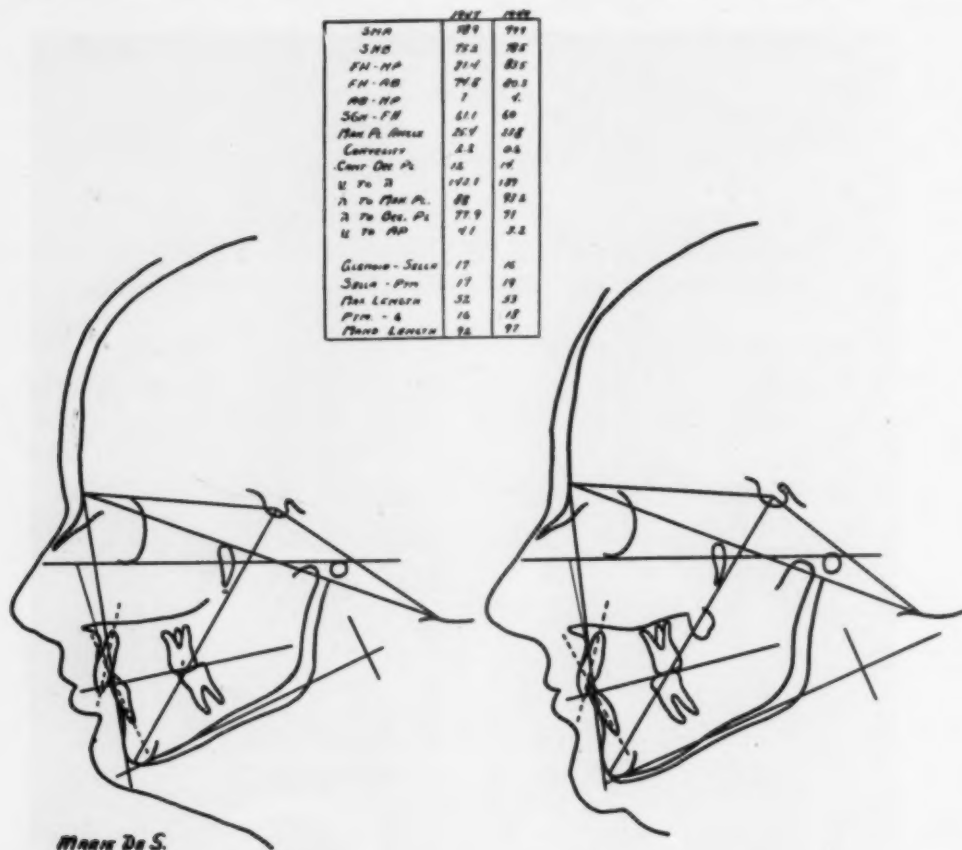


Fig. 22.—Profile tracings of Case No. 1600 before and after treatment. Note change in relationship of A-B line to both facial and occlusal planes.

With enough tipping and crowding, the mandibular teeth can be forced into mesioclusion, but the mandibular basal arch would still be distal. Analysis of cephalometric profile radiographs might indicate that the trouble is not always due to mandibular deficiency but could be due to overdevelopment of the maxilla or some region back of it, which caused a forward positioning of the maxilla. How would such a case be treated? By extraoral anchorage, attempting bodily distal and backward movement of all the maxillary teeth, including the incisors? This would set the whole maxillary dental arch back

inside of its basal arch. My guess is that this is not possible, but I do not know whether it is possible, or even desirable. In those cases in which it is not possible to affect a change in the anteroposterior relations of the basal arches through growth or repositioning of the mandible, a normal mesiodistal fit of the teeth is generally accomplished by some distal movement of the maxillary teeth and forward skid of the mandibular teeth and a change in cant of the occlusal plane.

Fig. 21 shows a Class II distoclusion which was treated with only a few appliance adjustments. In this case, the correction was almost wholly due to a four millimeter forward movement of the mandibular basal arch. There was some expansion of the maxillary premolars and very slight distal movement of the maxillary buccal teeth. There was almost no skidding of the mandibular teeth on their bony support, because very slight intermaxillary force was used and the change was in the basal arch relationship.

The tracings of the profile radiographs before and after treatment (Fig. 22) show what brought about this mesiodistal change. The second radiograph was made about a year after the active treatment was completed. The facial angle has opened up two degrees, which tallies with Downs' statement that one degree of change means a 2 mm. forward growth of the mandible. The orthographic projections (not illustrated) also showed that the mandibular basal arch moved forward 4 mm. The angle of the Y axis with the Frankfort plane has decreased somewhat, indicating a most favorable direction of growth for a distoclusion treatment. The FH-AB angle has increased, which coincides with the surveys. The actual measurements of the maxilla and mandible show that while the maxilla increased 1 mm. in length the mandible increased 5 mm. in over-all length, which accounts for the gratifying result.

In conclusion, if one carefully studies patients' models under the three headings suggested, that is: (1) the size and form of the basal arches, (2) the relationship of the teeth to these basal arches, (3) the relationship of the maxillary and mandibular basal arches to each other, and if the information obtained from this model study is correlated with that furnished by cephalometric profile radiographs, the patient's appearance, and the family background, bearing in mind the dictates of experience as to the limitations of tooth movement and denture stability, one may arrive at a reasonable plan of treatment.

Editorial

Evolution Emerging*

DR. WILLIAM KING GREGORY, the recipient of the Albert H. Ketcham Award in 1949, "in recognition of valuable contributions to the science and art of orthodontics," is known to practitioners of orthodontics throughout the world. American orthodontists have long had the benefit of listening to him at their national and sectional meetings. They will now have the opportunity of reading and studying Dr. Gregory in his new work *Evolution Emerging*.

Dr. Gregory's writing is a delight to read. He shows erudition without pedantry, humor without using the modern approach of "talking down to his audience." He takes it for granted that his reader has a high degree of intelligence, but always writes lucidly. The discussion of the significance, the "feel," of a million years, is in itself worth not only the price of these two volumes but also the time which so many find that they do not have for "reading books."

The publication of *Evolution Emerging* marks the culmination of a half century's research in comparative anatomy and related fields by Dr. William King Gregory, Curator Emeritus of Fishes and Comparative Anatomy at the American Museum of Natural History and Da Costa Professor Emeritus of Vertebrate Paleontology at Columbia University.

Volume one of the new work includes 735 pages of painstakingly authenticated and footnoted text which deals with the development of every major form of life on this planet until the present day. Volume two is exclusively devoted to more than 1,013 groups of figures representing more than 5,000 individual drawings. The bibliography covers 143 pages and the index contains more than 5,500 entries.

With characteristic modesty, Gregory gives due recognition to his predecessors at Columbia University, notably Bashford Dean and Henry Fairfield Osborn, and to his colleagues among whom he includes Milo Hellman.

In his introduction Gregory presents the reader with the perspective of evolution as a cosmic cinema or slowly turning kaleidoscope. He is impatient with clerics who pose as philosophers and scientists and who attempt to negate evolution as so-called "Darwinian Hypothesis." To correct some popular misconceptions of evolution, Gregory points out that the term, and in fact the process, does not denote a progressive synthesis or "upward change" in the direction of increasing complexity. He is careful to call attention to the fact that evolution as a progressive specialization and complexity in certain directions can take place only if there are compensatory reduction, degeneration, or loss of parts and apparent simplification in others. Furthermore,

**Evolution Emerging*. A Survey of Changing Patterns From Primeval Life to Man: By William King Gregory. A Collaborative Work of the American Museum of Natural History and Columbia University. Vol. I, 735 pp. and Vol. II, 1603 pp. Price, \$20. The Macmillan Company, New York, 1951.

evolution is sometimes taken to imply the theory that *all* forms of life have descended from a single or few ancestral forms. It goes without saying that evolution does not imply anything like the foregoing. From a practical standpoint, says Gregory, "the term carries the connotation that members of any systematic groups, such as the orchids among plants, have been derived by 'descent modification' from an ancient central stock which may in itself have included many interbreeding strains or varieties."

The evolutionary concept is now applicable to the entire field of science, including atomic physics, chemistry, astronomy, geology, and the rest. The evolution of thinking also shows itself in various ways. Gregory makes it clear that he has no interest in *proving* evolution, any more than modern mathematicians find it necessary to accept postulates other than those laid down by the mathematicians themselves.

As his first postulate Gregory calls evolution "the natural history of the universe and its parts." Evolution "deals with the processes and results of the transformation of energy and matter, viewed against the background of time and space." When did evolution begin? Well, the fossil record of organic evolution, with which Gregory is concerned, begins with the Paleozoic era and covers only the last quarter of the entire geologic record. This quarter is estimated to have commenced some five hundred million years ago. The modern unit of geologic time is one million years. This year being 1952 A.D., less than two thousand years since the Christian era began, let us stop and think for a minute what a million years means, even if five hundred million stuns the imagination. If you were taking an automobile trip covering 1,000 miles each week, without interruption, it would take you one thousand weeks or $19\frac{1}{2}$ years to cover a million miles.

In Chapter I, "The First Living Things," the author pays his respects to the sun as the source of food, hence energy of all living things. He proceeds quickly from the microscopic hosts to the invertebrates; the world of molluscs to the arthropods, the externally articulated animals. With respect to insects, Gregory states, "The warfare against insects should not be indiscriminate, lest we kill friends as well as foes." If the insects "did not carry pollen from flower to flower our gardens would soon be empty, our forests vanish and there would be no crops to feed man or beast." As Gregory tells it, his account of insects makes intensely interesting reading.

Part Two deals with the emergence of the vertebrates, in which the various theories of their origin are disclosed. Gregory's own "Eclectic Theory" takes us back several hundred million years "before the ancestors of man walked upright." An interesting account is presented of the jawless, well-jawed, bony, and air-breathing fishes which will keep the reader enthralled. How the air-breathers came up on land and went from lowland to marsh, to forest, and desert is a phase of evolution which leads to the discussion of the "primordial cranium." We learn of the last stand of a famous "living fossil" but remain puzzled as to why the dinosaur hosts were "cut off."

Gregory takes up through the dark ages of mammalian history to the rise of the placental mammals.

Part Five presents "The Devious Paths to Man." Here is presented an account of the origin, rise, and development of the primates from the tree shrew to *Homo sapiens*. In his discussion of the origin, rise, and development of the primates, Gregory includes many anecdotes which leave us with the impression that these "cousins" of man are far from being the mindless automata as they were termed by Descartes. Orthodontists will be especially interested in the contributions of Hellman as an independent worker, and, in collaboration with Gregory, on the ancestors of man.

In a chapter on "Man's Debt to the Past," Gregory traces the successive branchings and turnings of the long road that finally led to the peculiar side path on which man is now traveling. False pride and exclusiveness which are taken for granted by the majority of the white race, according to Gregory, do not controvert the facts "(a) that man is a made over ape and (b) that man is a vertebrate animal, with all the capacity for selfishness and predation that constitutes original 'sin'; from which the race is always needing redemption."

Dr. Gregory has been connected with the American Museum of Natural History since 1899 when he began his work as research assistant to the late Henry Fairfield Osborn. As assistant to Professor Osborn, Dr. Gregory was connected with the founding of the Columbia University courses for graduate students in the museum and later became lecturer and then Da Costa Professor of Vertebrate Paleontology of Columbia.

Dr. Gregory was a member of the following expeditions, mostly from the museum: to the lower Miocene deposits of Western Nebraska (1906), to Australia (1920), to the Sargasso Sea and the Galapagos Island (1925), to the Belgian Congo and the French Cameroons (1929), to Australia and New Zealand (1939), to South Africa (1939), to Bimini (1948, 1950, 1951). In 1950 he received the Viking Fund Gold Medal and Award in Physical Anthropology.

J. A. Salzmann.

Reports

REPORT OF THE COMMITTEE ON THE PRESIDENT'S ADDRESS

Mr. President and Members of the American Association of Orthodontists:

It was a pleasure for the members of the committee to accept appointment by Dr. Homer Robison to consider and report on the President's Address.

We most heartily concur with Dr. Johnson's expression of thanks to the members of the Program Committee, Dr. Clare Madden, Dr. James Ford, and Dr. Paul Lewis. Their efforts have obviously been appreciated as demonstrated by the favorable acceptance of those in attendance.

We wish to add our gratitude to that of Dr. Johnson to Drs. John Atkinson, Joseph Selden, Burke Coomer, and Wallace Standard and all others for their fine work in caring for the multitudinous details connected with the running of a meeting of this size. We further concur with his congratulations to Dr. Pollock and Dr. Eby for their fine accomplishments in the publication of the JOURNAL and to Dr. George Moore for his most efficient and helpful services as secretary-treasurer.

As Dr. Johnson stated, little has transpired in the affairs of the Society during the last year to necessitate lengthy discussion here. His recommendation that the Board of Directors discuss and decide upon the advisability of uniform qualifications for membership in the various sectional societies has already been brought before the Board.

The Committee agrees with Dr. Johnson's recommendation that the Chairman of the Nomenclature Committee collaborate with the American Dental Association committee in the compiling of a dental dictionary.

The fund established by the Canadian Orthodontic Society and endorsed by the Canadian Dental Society in memory of our beloved member, Dr. George Grieve, is a highly deserving honor and one in which many of our members may wish to participate by making a contribution.

The members of this committee appreciate that due to the increase in magnitude of our annual sessions, the Local Arrangements Committee of three men is too few in number and results in overburdening these men. We, therefore, agree that the Board of Directors should consider a change in the bylaws to provide for an increase in size of the Local Arrangements Committee.

The Reference Committee wishes to take this opportunity to congratulate Dr. Johnson for his fine administration and to express the sincere gratitude of the entire membership for the gracious and capable manner in which he has led us.

Respectfully submitted,

CECIL MULLER,

M. DUKE EDWARDS,

FRANKLIN A. SQUIRES, Chairman.

In Memoriam

M. DON CLAWSON, 1900-1951

"The American Father of Teeth"

IT IS rather unusual for a specialty journal to request a sketch of a general practitioner, but Don Clawson was an unusual dentist who worked for the profession, whatever the specialty, particularly in its relation to the rest of the world. He was endowed with a rare sense of geography, an intense desire to travel, a keen mind, a thirst for knowledge, a memory that was retentive, imaginative, and productive, and he was also endowed with the will to do and the energy and courage to do it with. He was a good dentist and a natural born writer.

With radiant smiles and eagerness to converse he upheld his end of the conversation even on topics he knew little or nothing about. He was never at a loss for words or subject matter. In this connection he once remarked to Mrs. Clawson that, if ever he failed to say something to someone in reply, she was to shake him to see if he is alive.

Although he spoke only English, his meager or lack of knowledge of other languages was not a handicap in his travels. Somehow he understood those who spoke to him in a foreign tongue, and somehow—with gestures, smiles, and key foreign words—he managed to make himself understood. It was more natural and easier for him to make friends than for experts to write on the subject. The far apart poles of the world, oil, international politics, recent advances in science and education, held as much interest for him as the local elections in his home town. He was well-read. He lived a life that was full and eventful, never caring to stop to look back with pride or regrets. He liked to look ahead and upward, whatever the hurdle or height.

His sense of seriousness was a rich blend with that which is comical and witty, which made him adept at telling stories, to entertain, to drive home a point, or to thwart the curious. Because of these qualities, not commonly combined in one man, he was able to serve his country well in his versatile and diversified career. It is, therefore, most difficult at this time, had one all the facts, to appraise what Don Clawson set out to achieve, some of which is, by necessity, enveloped in impersonal secrecy.

He was born at Flora, Ill., on Feb. 10, 1900, and died at Oak Ridge, Tenn., on Dec. 17, 1951. His ancestors came to the prairies of central Illinois from Denmark, by way of Scotland and Pennsylvania. He is survived by his widow, the former Miss Rue Stanford; their daughter, Carolyn; his sister, Mrs. Clara Clawson Stanford; and a large host of friends in America and in the world at large, rarely equaled by another contemporary dentist.

After attending the public schools of his home town, and service in the United States Navy (he enlisted), he came to St. Louis to study dentistry. He

worked his way through college and played football at St. Louis University. He transferred to Washington University at the end of his junior year, and was graduated with the Class of 1926.



M. DON CLAWSON

He practiced for a while at Bonne Terre, Mo., before returning to St. Louis to be associated with Lloyd B. Wright. He made a trip to England to study its panel dentistry. Then came the request to Washington University to recommend a professor of operative dentistry for the American University of Beirut, Lebanon. Walter M. Bartlett, then dental dean, selected Clawson, who was ever eager to trot the globe.

With Mrs. Clawson he arrived at Beirut, Lebanon, in the fall of 1930, and that is where our association began, an association most fortunate for me.

I still remember how he looked on the first day of his arrival: A ball of humanity, dressed in white and topped by a straw hat set at a becoming angle, smiling and with a warm handshake. He said he was there to learn, not to teach—a modest statement. Later we were to have adjoining offices with a common reception room, and still later I was privileged to work with him in the North Arabian Desert.

At Beirut he was well liked. Caste and snobbery were not for him. His sense of equality soon became apparent. He liked the people and their food. He understood and appreciated their customs. He was at home with the educated and with those who were educated in their own way. He taught dentistry and practiced it on a level Americans know best. To him money was only a medium of exchange.

About this time (early 1930's) the Iraq Petroleum Company was constructing its 1,200-mile pipe line, with a network of pumping stations, from the oil fields in Iraq to the terminals at Haifa and Tripoli on the eastern shores of the Mediterranean. Its Western officials and engineers sought him as a dentist, though his office was hundreds of miles distant. From them he soon learned that the company's almost complete medical department had no dental service for its thousands of employees, most of whom were on desert lands and sands. He sought the head officials and to them pointed out the error. He was asked to blueprint his idea of such a service and the equipment to implement it. The result was the now famous Dental Caravan, fully equipped for any dental service, and constructed to surmount the hazards of desert trails.

The dentist he recommended to the company soon found desert life unbearable and quit. To prevent a breakdown in the service for which he felt responsible, Clawson assumed its duties as Chief Dental Officer, after resigning his post at the American University of Beirut and giving up a lucrative practice.

Desert life was dry and dreary, but to him it was another world to conquer. His services were in great demand. In off duty hours he visited the friendly neighboring tribes and made surveys of their teeth and diet.

The nomads of the desert were people to Clawson. He sympathized with their hardships, understood their traditions, and respected their way of life. He was never molested. The tribal chief, Sheikh Ajile Al-Yawir, took a liking to him and later sent him a personal photograph. But the Sheikh forgot to autograph it.

"Take it back to him in person," Clawson remarked to me one day, "and ask him to sign it for me. That will be your chance to meet him." It took a week end of travel to have that done, but as a result of that memorable visit with the old warrior, now of blessed memory, I became the only non-Mohammedan member of his noble Shammar tribe—an honor I cherish and one I owe indirectly to another old warrior, now also of blessed memory.

One time, when the patient was a Bedouin laborer, and the dental assistant disinclined to regard him except as such, the Chief Dental Officer assembled his personnel and lectured to them that even laborers are entitled to the same attention as others of more fortunate standing on the company's payroll.

When snobbish officials wanted only the Chief to treat them, he said he had more important matters to attend to.

Sometimes the company preferred Westerners for certain jobs. Clawson suggested that nationals of the country be considered, when available. They were entitled to it and it would be cheaper for the company, he would argue. His friend, the general manager, listened. Thus, hundreds of employees owed their employment to him, their chief champion. He was missed when he returned to the United States in 1941.

The detailed story since his return had better be told by the Nashville group of his associates and colleagues, especially Oren A. Oliver. At Meharry Medical College he was director of dental education until 1945, when he became president of the college. In 1950, he resigned from the presidency and was elected to the board of trustees.

During World War II Don Clawson served with the Office of Strategic Services. When offered a cloak-and-dagger mission to the Middle East with no assurances to return, he accepted. Fortunately, the Battle of El-Alemein turned the tide, and he was able to return unscathed except for a little scratch. This was to be *the story* he wanted to tell, when the time for its "now it can be told" came. I hope he has left a record of it. I don't know it. Also during World War II he was chief dental consultant at Oak Ridge, at the time the atom bomb was in the making.

In recognition of some of his services to dentistry he was awarded the Pierre Fauchard Medal. He was very active in the affairs of the International College of Dentists, of which he was also a past president. In the Federation Dentaire Internationale he was equally active.

In recent years he was a sick man, yet ill health was no deterrent to what he wanted to do. A few months ago he wrote to say that he had just returned from the Persian Gulf, only to be hospitalized. His convalescence must have been incomplete. He died with his boots on, at his office at Oak Ridge, where he was chief dental consultant.

"Tis said that memory is life, that, though dead, men are alive." I can still picture him roaming the North Arabian Desert, in sun helmet and shirt sleeve, unmindful of its space and heat, dozing off occasionally, waking up to ask where he was, reminding Ramiz, his faithful driver and guide, to drive, not fly, then arriving at a desert station, smiling and refreshed, ready for work.

Abu Sinan al-American—The American Father of Teeth—they called him. He certainly left his footprints on the sands of time.

E. S. Khalifah.

EDWARD RAY STRAYER

1897-1951

DR. EDWARD RAY STRAYER, a prominent orthodontist of Philadelphia, Pa., died Sunday morning, Dec. 16, 1951, after a short period of illness.

Dr. Strayer was born on April 8, 1897, in York, Pa. He attended the York public schools, and following this early education engaged in the bookbinding

and paper ruling trades for several years. Also, during these years he studied music and played with local bands and orchestras, prior to World War I. He came to Philadelphia for further musical study under the eminent violinist and teacher, William Schradiek. During the war he enlisted in the Navy and served in Sousa's Band at the Great Lakes Naval Training Station.

Dr. Strayer graduated from the Dental School of Temple University in 1925. In 1933 he returned to his Alma Mater as an instructor in orthodontics and subsequently was elected to associate professor of orthodontics. He received his orthodontic training under Dr. Robert H. W. Strang at the Strang Postgraduate School of Orthodontia, and had from time to time returned to assist in postgraduate instruction.

He was on the Board of Governors of the Edward H. Angle Society of Orthodontia, and chairman of the eastern component of that society; a diplomate of the American Board of Orthodontics; a member of the Charles H. Tweed Seminar of Orthodontia, Strang-Tweed Study Group of New York, the Northeastern Society of Orthodontists, the American Association of Orthodontists, Pennsylvania Association of Dental Surgeons, American Society of Dentistry for Children, North Philadelphia Association of Dental Surgeons, the Academy of Stomatology, the Philadelphia County Dental Society, Pennsylvania State Dental Society, the American Dental Association, and a fellow of the American College of Dentists. He was sponsor of the Philadelphia Strang-Tweed Orthodontic Study Group.

He was past president of the Pennsylvania Association of Dental Surgeons, a past president of the Pennsylvania Society of Dentistry for Children, and past president of Temple University Dental Alumni Society.

His fraternal affiliations include membership in Phi Mu Alpha; Omicron Kappa Upsilon; Honorary Member of Tau Xi Psi; Xi Psi Phi; Friendship Lodge 400; F. & A.M.; Abington Chapter, R.A.M.; Mary Commandry, K.T.; Philadelphia Forest #10; T.C. of L.; and Lu Lu Temple A.A.O.N.M.S. He served as Deputy Supreme President of Gamma Chapter for eight years, as a member of the Board of Directors of the Supreme Chapter, and was past Supreme President of Xi Psi Phi.

He was a member of the American Legion; Manufacturers Golf and Country Club; High Twelve Club of Philadelphia; a director of the Betsy Ross Flag House, and active in civic organizations including the Montgomery County Housing Authority and the Montgomery County Republican Organization. He was a co-founder of the Adult School in Cheltenham Township.

Activities in the Patriotic Order Sons of America included past president of Camp 331; past district president of Montgomery County, District #4, and past state president. During his term as state president, he founded the George Washington Boys Camp.

He was engaged in the exclusive practice of orthodontics in Philadelphia.

He is survived by his wife, Sara Grube Strayer; daughter, Jane Strayer Hess; mother, Sophia R. Strayer; sister, Catherine E. Strayer; and grandson, Lawrence Edward Hess.

CHARLES MERVYN ALDERSON***1885-1951**

DR. CHARLES M. ALDERSON died on Nov. 30, 1951. He was born in Huntington, W. Va., Nov. 1, 1885, and came to California with his parents in 1888. He spent his boyhood days in Los Angeles, and entered the College of Dentistry, University of Southern California, graduating with the class of 1908.

He was a member of Xi Psi Phi Fraternity and helped to establish the Xi Psi Phi Alumni Association after his graduation, serving as its secretary for fifteen years.

In 1910 he married Miss Helen Foresman Griffith. They had two daughters, Elizabeth and Virginia.

In 1926, Dr. Alderson retired from general practice, devoting his time to the practice of orthodontics exclusively. In 1927 he was appointed secretary of the Los Angeles County Dental Society, and in 1928 was elected secretary of the Southern California State Dental Association. He continued as secretary of both organizations until 1932. He served as president of the Los Angeles County Dental Society in 1932-1933.

During his term of office he was called upon by the Board of Education of the Los Angeles City Schools to assist 10,000 school children to obtain dental relief. Under Dr. Alderson, some 400 dentists volunteered and successfully carried on this project. For this service he received the Silver Medal and Diploma of the Ling Foundation, "For Distinguished Service for Health Progress of Children."

In 1934 he was honored with the presidency of the Southern California State Dental Association. He had the honor of founding the *Southern California State Dental Journal*, even penning the first two issues himself.

Dr. Alderson was always energetic in campaigns for dental education. He was a life member of the Los Angeles County Dental Society, The Southern California State Dental Association, The American Dental Association, and The Supreme Council of the Xi Psi Phi Fraternity.

He was also a member of the Pacific Coast Society of Orthodontists, the American Association of Orthodontists, and the Johnson Orthodontic Club of Louisville, Ky.

The profession has lost in the passing of Dr. Alderson one who has contributed greatly to its advancement.

*From the Bulletin of the Pacific Coast Society of Orthodontists, Vol. 27, No. 4, 1951.

Department of Orthodontic Abstracts and Reviews

Edited by

DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmänn, 654 Madison Avenue, New York City

Calculation of "Normal" Weight in Children (By Means of Nomograms Based on Selected Anthropometric Measurements): By Maury Massler and Theodore Suher. *Child Development* 22: 75-94, June, 1951.

"Normal" weight may be defined as that weight which a particular individual should enjoy under optimal nutritional conditions. "Normal" weight is indicative of an "ideal" balance of soft tissues (muscle, subcutaneous and adipose tissue) on that particular bony skeleton. Weight is markedly influenced not only by height, age, and sex, but also by bodily habitus and genetic constitution.

Pediatricians have generally recognized a relationship between physical health and fitness on the one hand and adequacy of body size, bodily proportions, and weight on the other. Regular and reasonable gain of weight during infancy and childhood has become accepted as one of the indications of satisfactory health and nutrition; and the failure to gain, as distinct evidence and warning that something is amiss. In addition to weight, periodic anthropometric measurements have for some time been recognized as essential adjuncts for the appraisal of the physical status of a child. However, the accumulation, recording, and interpretation of these measurements have been cumbersome and inadequate for the general practitioner of medicine and dentistry, and as a result greatly neglected by him.

This paper represents an effort to present a simplified but accurate method for calculating the "normal" weight of a child incidental to the complete assessment of his physical development.

The use of nomographic profiles to determine "normal" weight was demonstrated by Massler. He incorporated chest circumference (at quiet expiration) and height into a formula for the calculation of weight. The study was based on more than one thousand males and females in optimal health and nutritional status. They ranged in age from birth to 50 years. The coefficient of correlation between the calculated and observed weights was found to be $\pm .82$.

In all of these studies, it was evident that the factor of body build could not be omitted from any attempt to predict "normal" weight. Two methods of estimating body build are in general use today—the subjective method as suggested by Sheldon and Tucker and the more objective grid method as suggested by Wetzel.

Intensive studies carried out during recent years have shown that while a wide range of difference exists among children of the same age, individuals tend to remain in a relatively stable position with respect to the normal distribution, from period to period. Except during the period of adolescence,

children tend to grow in an orderly and predictable manner. The most recent study on this subject was offered by Stuart and Meredith in 1946 and 1947. They published a complete series of body measurements taken at half-yearly age intervals from 5 to 18 years and arranged in a decile distribution from smallest to largest, for use in school health programs. These tables enable the examiner to locate the relative position of each one of the several body measurements taken. Cross-sectional or longitudinal data may be analyzed with equal facility. The examiner may then interpret the whole set of data or any one of the individual measurements as he sees fit. This system has the great virtue of avoiding the tendency to "classify" a given child and permits greater flexibility in interpretation by the examiner, yet offers an objective guide to his judgment.

The present study is based on 3,200 measurements taken on a group of 531 white American children, of whom 42.7 per cent were girls, and 57.3 per cent boys, ranging in ages from 5 years, 4 months to 17 years, 6 months. All of the children were residents of the Mooseheart Home for Orphaned Children, located at Mooseheart, Ill. The children came from every state in the United States and had been in residence at this institution for an average of three to four years, ranging from two months to thirteen years. (Only twenty-one children, or 3.95 per cent of the total group, had been residents for three months or less.) Ages were revised to the nearest half-birthday to facilitate analysis.

Somatotyping.—Each child was classified according to a simplified numerical scale by visual estimation of his body build and general physique:

Group I. Extreme ectomorphy (extremely slender or thin).

Group II. Ectomorphy (slender).

Group III. Moderate ectomorphy (moderately slender).

Group IV. Mesomorphy (average build).

Group V. Moderate endomorphy (moderately stocky).

Group VI. Endomorphy (stocky).

Group VII. Extreme endomorphy (obese).

Correlation of Height-Circumference Ratios With Age.—In order to determine the significance of the various girth measurements, each girth was related to the linear height of each child and the ratio thus obtained was plotted against age.

If a given girth to height ratio increases (or decreases) with age, then that girth must have increased more (or less) rapidly with age than did the height. Such a ratio indicates changes in body proportions that occur with age. If, however, a given girth to height ratio remains fairly constant throughout the age range studied, it indicates constancy in these bodily proportions during growth. Such a ratio is therefore determined by the somatotype rather than by age. *A constant ratio indicates unchanging bodily proportions* which are determined by the somatotype in contrast to a changing ratio which indicates bodily changes which occur during development.

The height-calf girth ratio for boys and girls exhibited the lowest correlation with age (-0.19 and $+0.04$) whereas the height-neck girth ratio showed the highest correlation with age ($+0.55$). This means that the neck circumference when related to height increased directly and significantly with the age of the child. Scammon pointed out that neck girth, like head circumference, follows a neural type of growth in infancy and childhood and shows a marked parapuberal spurt consonant with general body growth. Calf girth, on the other hand, when related to height, does not change significantly with age.

Height/Calf Girth:

- 4.45 and lower—extremely stocky or obese (extreme endomorphy).
- 4.46 to 4.65—stocky (endomorphism).
- 4.66 to 4.85—moderately stocky (moderate endomorphy).
- 4.86 to 5.05—average build (mesomorphy).
- 5.06 to 5.25—moderately slender (moderate ectomorphy).
- 5.26 to 5.45—slender (ectomorphy).
- 5.46 and higher—extremely slender or thin (extreme ectomorphy).

Prediction of Normal Weight from the Empirical Formula:

$$\frac{(\text{Circumference})^2}{K} \times \text{Height} = \text{Weight}$$

Since body weight (volume) is a function of the height, width, and depth of the body, the calculation of body weight may be said to be a function of height multiplied by a circumference of the body. The formula offered above was derived by Massler on the basis that the human body may be represented by an irregular cylinder whose specific gravity, under ideal conditions of tissue balance, approximates 1.0. The weight of this cylinder could be calculated by multiplying its height by the square of its "average" circumference divided by "pi" and a correction factor (K) for the irregularity of the cylinder. Body weight may, on this basis, be considered to vary only with body contour. A girth which varied only with body type and not with age would make an ideal indicator of weight.

The high correlation of the height-calf birth ratio with the somatotype suggested the use of this girth in the calculation of "normal" body weight in addition to, or instead of, the chest circumference as indicated by Massler. The K factors in the weight formula given above were, therefore, calculated for each child using chest, neck, and calf circumference.

This analysis showed that the K factor is a very reliable figure for each of the circumferences tested. The odds are greater than 99 to 1 that in repeated samples the means would occur within the limits stated. For example, great reliance can be placed upon the probability that, in future samples, the mean of the constant in the formula using leg girth for boys will fall within the range of 3.247 ± 0.0324 .

$$K = \frac{(\text{Circumference})^2}{\text{Weight}} \times \text{Height}$$

On the basis of the findings the calculated means can now be substituted into the formula in order to derive a "normal" weight. As an example, the formula for the calculation of weight using calf girth would read:

$$\frac{(\text{Calf Girth})^2}{3.247} \times \text{Height} = \text{Weight (Boys)}$$

$$\frac{(\text{Calf Girth})^2}{3.334} \times \text{Height} = \text{Weight (Girls)}$$

(Height and girth measurements are recorded in centimeters; weight in kilograms.)

SEX DIFFERENCES

The numerical values for the constants in the formula are the means derived for each sex by substituting the measured height, calf girth, and weight in the formula and solving for K. Statistical analysis showed that there was a significantly greater reliability in predicting weight if *different* values of the

constant "K" were used for each sex. This eliminated the possibility of combining the sexes and using a single constant as was done by Massler. The increased accuracy in predicting weight justified this procedure. The probability that the difference between the constants for boys and girls did not occur by chance was better than 99 to 1.

NORMAL WEIGHT FOR BOYS

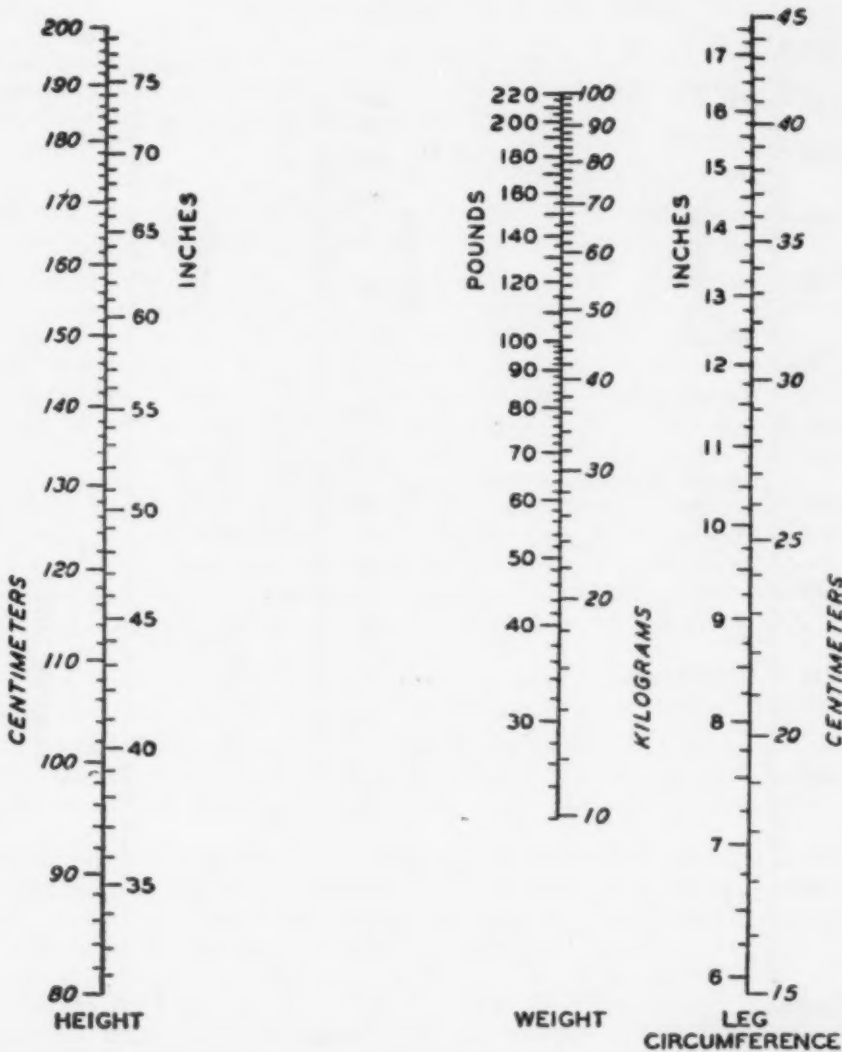


Fig. 1.—Nomogram for the calculation of "normal" weight for boys aged 5 to 18 years, using calf girth.

EASE OF CLINICAL PROCEDURES

In the clinical application of the three girth measurements, the chest circumference was found to be the most difficult to measure accurately because of respiratory movements and the depositions of subcutaneous adipose tissue near

the area measured. A serious defect in the clinical use of this measurement appeared when it was taken over clothes, as in older girls. Of the three circumferences tested, the calf girth was found to be the simplest and easiest to obtain and least susceptible to errors in measurement. It should be noted that an error in the measurement of the calf girth is likely to be more significant than an

NORMAL WEIGHT FOR GIRLS

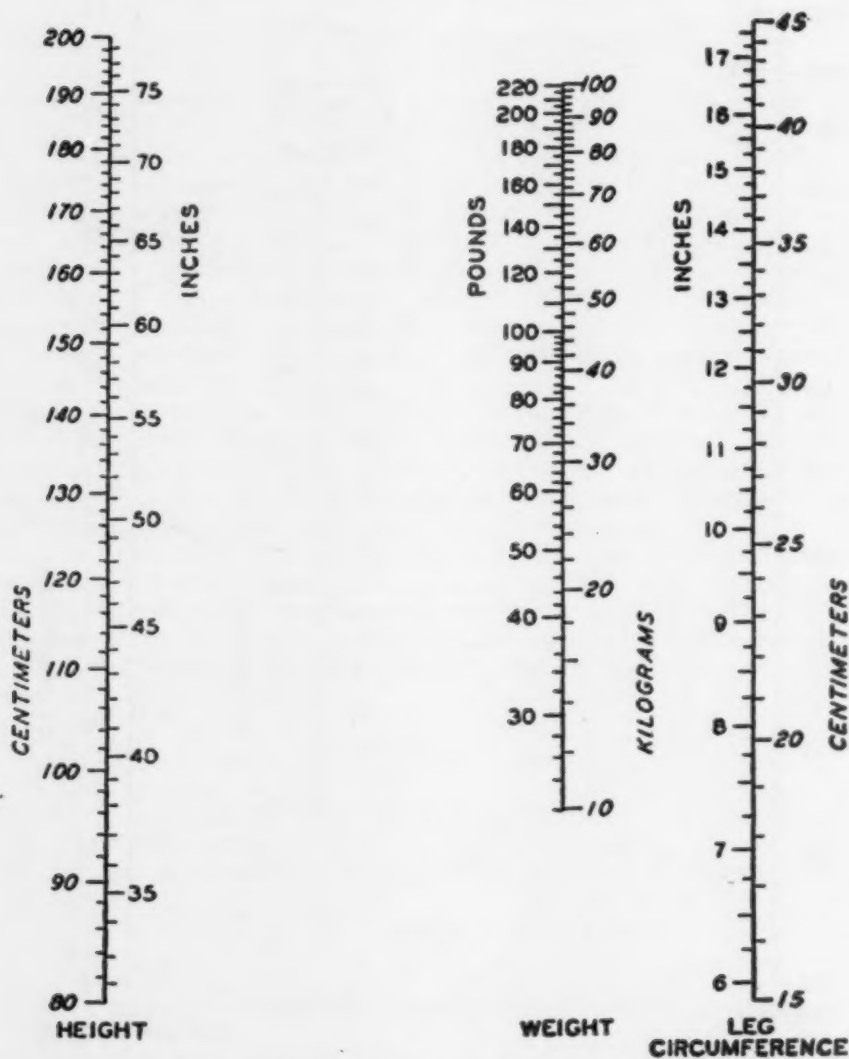


Fig. 2.—Nomogram for the calculation of "normal" weight for girls aged 5 to 18 years, using calf girth.

error in the chest circumference measurement because of the smaller dimensions of the calf birth. While the neck girth was also simple to obtain, it could not be used because of the marked changes in proportion to height as the child increased in age.

NOMOGRAMS FOR THE CALCULATION OF "NORMAL" WEIGHT

In order to eliminate the necessity for tedious calculations, two nomograms were devised for the calculation of "normal" weight in children, using height and calf girth. These nomograms (Figs. 1 and 2) show the mathematical relationship between the three variables, as presented in the weight calculation formulas:

$$\frac{(\text{Calf Girth})^2}{3.247} \times \text{Height} = \text{Weight (Boys)}$$

$$\frac{(\text{Calf Girth})^2}{3.334} \times \text{Height} = \text{Weight (Girls)}$$

The proper points on the lines labeled height and calf circumferences are marked and connected with a straight edge. The calculated weight is read directly from the scale in pounds or kilograms.

SELECTION OF MEASUREMENTS

Several factors must be borne in mind in the selection of proper anthropometric measurements for routine use in office or clinic:

a. They must be as few in number and as easy to obtain as possible. Experience has shown that strict scientific accuracy and completeness must sometimes be sacrificed for the sake of simplicity and practicability. It is well known that teachers, nurses, physicians, and particularly dentists will not make use of complicated standards even though their accuracy may be quite superior. They are much more likely to use standards that can be referred to quickly and easily and whose results can be quickly interpreted from tables. These practical factors have been kept foremost during this study.

b. The smallest possible error in obtaining these measurements is a very important factor in their selection. It is obvious that unless the child can be almost completely undressed for the examination, the errors of chest and hip girth measurements are measurably increased. For this reason, both neck and calf circumferences were tested in an attempt to find a girth both clinically feasible and least subject to error of measurement.

c. The measurements selected must be those which, logically and mathematically, are best suited to judge the normal development of the individual.

Through long experience, it has been established that *stature*, of all skeletal measurements, best represents gross linear size and rate of linear growth.

Body weight was included because it alone sums up the entire mass of the body.

Chest circumference has long been recognized as an important measure of the character of the bony skeleton and thus the body build of the patient. McCloy, in his analysis of children, found that the circumference measurement was better than the best combination of depth and breadth of chest, and "as far as predicting normal weight is concerned, the circumference of the chest measured at the Xiphoid level is the best." Massler also found that this measurement at the Xiphoid level was best because it was little influenced by fat deposits, was not influenced by secondary sex characteristics in the female, and was the most exact of all circumferential measurements in the calculation of the mean circumference of the body.

The size of the musculature and its important contribution to body weight make necessary the consideration of this factor in all predictions of body weight. Although musculature alone can be measured independently only by roentgenograms, certain circumferences of the body are directly influenced by amount of the subjacent muscle mass (calf girth) just as others are directly influenced

by the amount of subcutaneous adipose tissue (abdominal girth). Both neck and calf circumferences were considered in this study in order to determine their influence upon the calculation of body weight. Neck girth was found to be greatly influenced by subcutaneous tissue and by age and therefore not useful in the calculation of weight. Calf girth varied directly only with weight (height being held constant). Calf girths apparently reflect only the amount of bone and muscle mass since the amount of subcutaneous adipose tissue is, in proportion to the muscle mass, relatively small in this area. This is true even in obese persons. The predictive value of calf girth in determining "normal" weight in obese persons should be very high. Such studies are now in progress.

Somatotyping.—The problem of objectively determining the body build or somatotype of a given child is not simple. A knowledge of the inherent growth pattern and eventual body build of the child is important in the prognosis of growth. At the present time, the practitioner must take recourse either to an examination of parents and siblings from whose body build he may *estimate* the eventual somatotype of the child or a long range longitudinal study of the child. This is not often possible.

SUMMARY AND CONCLUSIONS

1. Selected anthropometric measurements were taken in a group of 538 midwestern children (aged $5\frac{1}{2}$ to $17\frac{1}{2}$ years) in maximal health and good nutritional status. These were analyzed in order to discover a simplified but accurate method for calculating the "normal" weight of an individual.

2. *Neck girth* was tested as an indicator of body weight. It was found that neck girth varied with both body build and the age of the individual. This measurement is, therefore, too complicated to use in any prediction formula.

3. *Chest circumference at the Xiphoid level* was measured, and this girth was found to be a very reliable index of weight when combined with height. This substantiated previous findings by Massler.

4. *Calf girth* was found to bear a specific and very close relationship to body weight, regardless of age. This measurement was found to be directly and closely related to the body build (somatotype) of the individual. It has advantages over the chest circumference measurement (which is also closely related to body build) in that it is easy to obtain and subject to only small errors in measurements.

5. *Calf girth and height* were used in the prediction formula as suggested by Massler, and constants were derived for boys and girls. The correlation coefficients between the actual and predicted weights (to within one kilogram) were then calculated and found to be +.9902 for boys and +.99994 for girls.

6. A *channel diagram* similar to the Wetzel Grid is presented for the determination of body type in children and on the basis of the constant relationship between height and calf girth at all ages examined. This method of channelization has the advantage of indicating the *inherent* or "normal" body build of the child rather than the present status as indicated by the Wetzel Grid.

7. Two *nomograms* based on the measurement of calf girth and height are presented for the calculation of "normal" or "ideal" weight of children aged $5\frac{1}{2}$ to $17\frac{1}{2}$ years. These measurements are easy to obtain in the clinic, office, or school, and sufficiently accurate in their predictive value of "ideal" weight to make them useful to the practitioner.

News and Notes

American Association of Orthodontists

The scientific program for the 1952 session is complete. All members of dental, medical, and allied professions are cordially invited to attend.

The following is a classification of nonmembers and schedule of attendance fees which will be charged at the time of registration:

A. NO ATTENDANCE FEE

1. Full-time teachers in university dental schools.
2. Full-time graduate or postgraduate students in university orthodontic departments.
3. Dentists from outside Canada or the United States who are members of recognized dental or orthodontic organizations.

B. ATTENDANCE FEE \$10

1. Associate, junior, or probationary members of constituent societies of the A.A.O.
2. Those whose applications for membership in constituent societies of the A.A.O. are pending.
3. Associates (in practice) of A.A.O. members.
4. Part-time teachers in university dental schools.
5. Part-time graduate or postgraduate students in university orthodontic departments.

C. ATTENDANCE FEE \$20

1. Graduates of university orthodontic departments who are not members of constituent societies of the A.A.O.
2. Other guests.

The officers and committees of the American Association of Orthodontists for 1952 follow:

Bernard G. deVries President 705 Medical Arts Bldg. Minneapolis, Minn.	Brooks Bell President-Elect 4150 Mockingbird Lane Dallas, Texas	Malcolm R. Chipman Vice-President Paulsen Bldg. Spokane, Wash.	George R. Moore Secretary-Treasurer Box 8 Ann Arbor, Mich.
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BOARD OF DIRECTORS

One director from each constituent society

Bernard G. deVries	George H. Siersma	Walter S. Sargeant
Brooks Bell	Silas J. Kloehn	Philip E. Adams
Malcolm R. Chipman	Frederick R. Aldrich	Frederick T. West
George R. Moore	Allan G. Brodie	Clyde O. Wells
	J. A. Salzmann	E. C. Lunsford

COMMITTEES

<i>Budget</i>	<i>Constitution and Bylaws</i>	<i>Public Health</i>
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William A. Murray, 1953 Glenn F. Young, 1954	Oren A. Oliver, 1953 Leo M. Shanley, 1954	Leigh C. Fairbank, 1952 Herbert K. Cooper, 1953 B. Holly Broadbent, 1954 L. Bodine Higley, 1956

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Earl E. Shepard, 1953
Joseph D. Eby, 1954

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Robert E. Moyers, 1953
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C. F. Stenson Dillon, 1953
Nathan G. Gaston, 1954

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George M. Anderson, 1954

Relief

Frederick T. West, 1952,
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San Francisco 2, Calif.
L. T. Walsh, 1953
W. Wayne White, 1954

Interrelations

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Montreal, Quebec, Canada
John W. Richmond, 1953
Andrew F. Jackson, 1954

Necrology

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Nissen Bldg.
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Scott T. Holmes, 1954

Laws and Infractions

Clyde O. Wells, 1952,
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Ralph G. Bengston, 1953
Holly Halderson, 1954
John B. McCoy, 1955
William M. Pugh, 1956

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W. Robert MacConkey, 1952
Ernest T. Klein, 1953
Marion A. Flesher, 1954
Paul V. Reid, 1956

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2376 E. 71st St.
Chicago, Ill.
Frank P. Bowyer, Jr.
Wilson R. Flint
Ashley E. Howes
John R. McCoy

Librarian

Charles B. Baker, 1954
636 Church St.
Evanston, Ill.

Program

Max E. Ernst, Chairman
1250 Lowry Medical Arts Bldg.
St. Paul, Minn.
L. Bodine Higley
Ernest L. Johnson
Silas J. Kloehn
Lowrie J. Porter
J. A. Salzmann (ex officio)

Local Arrangements

Leo M. Shanley, Chairman
7800 Maryland Ave.
St. Louis, Mo.
E. V. Holstine, Treasurer
8015 Maryland Ave.
St. Louis, Mo.
Otto W. Brandhorst
George H. Herbert
Benno E. Lischer
Albert C. Mogler
H. C. Pollock
Frank C. Rogers
Henry F. Westhoff
Joseph H. Williams

An information booth will be located near the registration desk. When you receive your questionnaire, a pamphlet will be enclosed with information of places you may wish to see while in St. Louis.

On Tuesday night there will be a baseball game between the St. Louis Browns and Cleveland. Please make reservations direct if you wish to attend that event. We plan to have our Association there in a group.

For any other information, please call upon us after your arrival.

YOUR INFORMATION COMMITTEE.

LADIES' ENTERTAINMENT PROGRAM

A program of interesting events for the ladies has been arranged for the meeting in St. Louis, April 20, 21, 22, 23, and 24, 1952. There will be an informal buffet supper in the Gold Room of Hotel Jefferson, Sunday evening, April 20, at 7:00 P.M., for both the ladies and the men.

The ladies will have a cocktail-buffet dinner at the University Club, Monday evening, April 21, at 7:00 P.M. Busses will leave the Twelfth Street entrance of Hotel Jefferson at 6:30 P.M. On this occasion, each lady is asked to wear her identification badge which she will receive upon registration.

A luncheon and radio show, in the Gourmet Room of the Park Plaza Hotel, are planned for Tuesday, April 22, at 1:00 P.M. Busses will leave the Twelfth Street entrance of Hotel Jefferson at 12:30 P.M.

The high lights of the convention will be Wednesday night, April 23, at 7:00 P.M., in the Gold Room of Hotel Jefferson—the president's reception, banquet, entertainment, and dance.

The wives of the officers of the Association, the wives of the presidents of the sectional societies, and the wife of the president of the American Board of Orthodontics are being asked to act as hostesses for the Monday night meeting. They will be assisted by the wives of the local St. Louis orthodontists.

EARL C. BEAN, CHAIRMAN,
LADIES' ENTERTAINMENT COMMITTEE.

Research Section Meeting of the American Association of Orthodontists

In accordance with the policy of recent years, time will be set aside for research reports at the coming meeting of the American Association of Orthodontists. Any individual desiring to report on a current research problem, completed or in progress, may do so by communicating with Dr. John R. Thompson, 311 East Chicago Ave., Chicago, Ill.

Each application should be accompanied by the author's name, address, and institution with which he works, if any. An abstract of not more than three hundred words should be forwarded at the same time. The abstracts must be in the hands of the committee not later than March 15, 1952.

Presentation time will be limited to ten minutes.

J. A. SALZMANN, Chairman.

Prize Essay Contest, American Association of Orthodontists

Eligibility.—Any member of the American Association of Orthodontists; any person affiliated with a recognized institution in the field of dentistry as a teacher, researcher, undergraduate or graduate student shall be eligible to enter the competition.

Character of Essay.—Each essay submitted must represent an original investigation and contain some new significant material of value to the art or science of orthodontics.

Prize.—A cash prize of \$500 is offered for the essay judged to be the winner. The committee, however, reserves the right to omit the award if in its judgment none of the entries is considered to be worthy. Honorable mention will be awarded to those authors taking second and third places. The first three papers will become the property of the American Association of Orthodontists and will be published. All other essays will be returned.

Specifications.—All essays must be typewritten on 8½ by 11 inch white paper, double-spaced with 1 inch margins, and composed in good English. Three copies of each paper, complete with illustrations, bibliography, tables, and charts must be submitted. The name and address of the author must not appear in the essay. For purposes of identification, the author's name, together with a brief biographical sketch which sets forth his or her dental and/or orthodontic training, present activity and status (practitioner, teacher, student, research worker, etc.), should be typed on a separate sheet of paper and enclosed in a sealed envelope. The envelope should carry the title of the essay.

Presentation.—The author of the winning essay will be invited to present it at the meeting of the American Association of Orthodontists to be held at St. Louis, Mo., April 21-24, 1952.

Final Submission Date.—No essay will be considered for this competition unless received in triplicate by the Chairman of the Research Committee on or before March 1, 1952.

J. A. SALZMANN, CHAIRMAN, RESEARCH COMMITTEE,
AMERICAN ASSOCIATION OF ORTHODONTISTS,
654 MADISON AVE.,
NEW YORK 21, N. Y.

American Board of Orthodontics

The next meeting of the American Board of Orthodontics will be held at the Hotel Jefferson, St. Louis, Mo., April 16 to April 20, 1952. Orthodontists who desire to be certified by the Board may obtain application blanks from the Secretary, Dr. C. Edward Martinek, 661 Fisher Bldg., Detroit 2, Mich. To be considered at the St. Louis meeting, all applications must be filed before March 1, 1952.

St. Louis Society of Orthodontists

The annual meeting of the St. Louis Society of Orthodontists was held Monday, Jan. 28, 1952. The following officers were elected:

President	Earl C. Bean
Vice-President	Robert E. Hennessy
Secretary-Treasurer	Everett W. Bedell

The St. Louis Society of Orthodontists extends a most cordial welcome to all members of the American Association of Orthodontists, their wives and friends, to attend the meeting in St. Louis April 20, 21, 22, 23, and 24, 1952.

The Great Lakes Society of Orthodontists

At the November meeting of the Great Lakes Society of Orthodontists, held at the Statler Hotel in Cleveland (Nov. 5, 6, and 7), the following officers, as well as committee chairmen to their respective committees, were elected:

President, Dr. Holly Halderson, Toronto, Ontario, Canada.
Vice-President, Dr. Earl G. Jones, Columbus, Ohio.
President-Elect, Dr. Scott T. Holmes, Muskegon, Mich.
Secretary-Treasurer, Dr. Carl R. Anderson, Grand Rapids, Mich.
Delegate to A. A. O., Dr. Richard E. Barnes, Cleveland, Ohio.
Alternate delegate, Dr. Robert MacConkey, Rochester, N. Y.
Committee Chairmen
Board of Censors, Dr. Robert E. Wade, Columbus, Ohio.
Legislative, Dr. Fred Black, Cincinnati, Ohio.
Judicial, Dr. J. Hilliard Hicks, Detroit, Mich.
Constitution and Bylaws, Dr. Frank Cartwright, Detroit, Mich.
Public Relations, Dr. Carl R. Anderson, Grand Rapids, Mich.

The Twenty-third Annual Meeting of the Society will be held at the Royal York Hotel, Toronto, Ontario, Canada, Nov. 10, 11, and 12, 1952.

American Dental Association

Dr. Otto Brandhorst, for many years a member of the American Association of Orthodontists, was elected President of the American Dental Association Oct. 15, 1951.

He will assume the duties of president at the close of the ninety-third annual session in St. Louis next year. Dr. Brandhorst was born in Nashville, Ill., on March 29, 1889, and was graduated from Washington University School of Dentistry in 1915. As a teacher, administrator, and specialist in orthodontics he has served the dental profession actively and well for many years. He has been president of the St. Louis Dental Society and the Missouri State Dental Association, and editor of the *Journal of the Missouri State Dental Association*. In 1935 he served on the Dental Advisory Council to the Committee on Economic Security and in 1945 he was consultant on dental study for the Bureau of Research and Statistics, Social Security Board. He is a member of the Council on Dental Education of the American Dental Association, serving as chairman of two of that Council's committees, the Committee on Training of Dental Hygienists and the Committee on Inspection Forms. He has served for many years in the House of Delegates of the Association. He contributed liberally to dental literature and has appeared on scientific programs of many dental societies throughout the country. Since 1945 he has been dean of Washington University School of Dentistry.



OTTO BRANDHORST

Dr. Brandhorst adds to the long list of orthodontists who are past-presidents of the American Dental Association.

The president of the American Dental Association listed four rules of dental health for the nation's children as communities throughout the nation prepared for the fourth annual National Children's Dental Health Day Monday, February 4.

In hundreds of communities, state and local dental societies of the Association joined with parents, teachers, health educators, civic leaders, and others in sponsoring special programs designed to stimulate public interest in the dental health problems of children.

Dr. LeRoy M. Ennis, of Philadelphia, Association President, recommended the following fourfold program as a "practical means of providing children with sound dental health":

1. A well-balanced diet with consumption of sweets kept to a minimum. It is the sugar that is the prime cause of dental decay.
2. Proper toothbrushing habits that should be learned early. This means brushing the teeth within ten minutes after eating.
3. Early detection and treatment of dental disease. This will prevent larger dental ills later on. Neglect may produce serious dental problems which will continue throughout life.
4. Either access to drinking water from a community water system containing the proper amount of fluorides for tooth decay prevention or application of sodium fluoride to the child's teeth at periodic intervals. Children who drink fluoridated water from birth have from one-half to two-thirds less tooth decay than those who drink fluoride-free water.

Dr. Ennis pointed out that tooth decay afflicts more than 90 per cent of children of school age to make it childhood's most common disease. He emphasized the importance of preventive procedures in combating dental disease among children.

"If the preventive and control methods now known are used to the fullest extent, there is small reason for children to reach adulthood crippled by the dental disorders that have plagued their parents and grandparents," Dr. Ennis said.

"Never before in its history has the dental profession been possessed of so many effective weapons to achieve the basic objective of any health profession: the prevention and control of disease. The public health approach to dental decay has become a fact instead of a wished-for fancy." He added:

"The development and expansion of community health programs to make dental health education and care available to all children is the most practical way of improving the nation's dental health."

British Society for the Study of Orthodontics

Harold Chapman, of London, was recently elected President of the British Society for the Study of Orthodontics. This is the second time that Dr. Chapman has served as President of this organization. His first period was in the year 1925.

Northcroft is the only other member of this Society to have served two times.

Australian Society of Orthodontists (Victorian Branch)

The inaugural meeting of the Australian Society of Orthodontists (Victorian Branch) was held at the Australian College of Dentistry on Sept. 5, 1951. Dr. A. Thornton Taylor, Federal President of the Society, came from Sydney to attend the meeting, and the following office bearers were elected: Chairman, Mr. C. R. Newbury; Secretary, Mr. J. V. Wilkinson; Treasurer, Dr. D. F. Spring; Associate Representative, Mr. E. Storey.

JOHN V. WILKINSON, Honorary Secretary.

American Association for Cleft Palate Rehabilitation

At a meeting in Washington, D. C., on Oct. 17, 1951, the Executive Council directed the President, Dr. H. Koepf Baker, to explore further the subject of time and place for the Tenth Annual Convention of the Association for the spring of 1952. A committee consisting of Drs. C. S. Harkins, Carl O. Boucher, and W. J. Robinson was appointed to assist the President in selecting a place and time of meeting which would be most advantageous to the Association.

After considerable investigation, this group concluded that the meeting should be held in St. Louis, Mo., on Friday, April 25 and Saturday, April 26, 1952, at the Chase Hotel, Washington University Dental and Medical Colleges, and Barnes and Children's Hospitals.

Dr. Cecil R. Conroy, First National Bank Bldg., Belleville, Ill., has been appointed to the chairmanship of the Program Committee. He will be assisted by a committee which represents the professional fields and which recognizes geographical areas. Dr. Conroy has requested that all correspondence concerning essays, papers, clinics, and demonstrations be sent to him at the above address.

The President has requested the Editor to issue a formal call for papers and urges all members who would like to present papers, demonstrations, films, or participate in the program in any other way to write directly to Dr. Conroy. If you know of any nonmember who might make an interesting contribution to this tenth annual convention program send your suggestion to the program chairman.

Assistant Chief of the Navy Bureau of Medicine and Surgery for Dentistry Retires

Rear Admiral Spry O. Claytor, Dental Corps, United States Navy, was placed on the retired list of officers of the Navy on Jan. 1, 1952, after more than thirty-four years continuous active naval service. He was appointed to the rank of Rear Admiral July 15, 1942, and has served as the Assistant Chief of the Bureau of Medicine and Surgery for Dentistry and Chief of the Dental Division since June, 1950.

Federal Security Agency, Social Security Administration, Children's Bureau

Dr. Arthur J. Lesser has been appointed director of the Division of Health Services of the Children's Bureau, Federal Security Agency, Dr. Martha M. Eliot, Bureau Chief, announced recently.

Dr. Lesser succeeds Dr. Edwin Daily, who resigned to become Deputy Medical Director of the Health Insurance Plan of Greater New York.

As director of health services, Dr. Lesser will be responsible for the administration of the maternal and child health and crippled children's programs of the Children's Bureau. These programs administer grants to the States totaling close to \$24,000,000 this year.

Notes of Interest

Oliver H. Devitt, D.D.S., and Curtis E. Burson, D.D.S., announce their association in the exclusive practice of orthodontics at 523 Republic Bldg., Denver, Colo.

Dr. Leonard Gorelick announces his association with Drs. Paul and Howard Grindlinger in the exclusive practice of orthodontics at 119-04 80th Road, Kew Gardens, Long Island, N. Y.

Dr. I. Fred Gross announces the opening of his office limited to the practice of orthodontics at 31 West St., Danbury, Conn.

Dr. Murray A. Rice announces the removal of his office from 21 Elm St., to the Professional Bldg., 27 Elm St., Worcester, Mass., practice limited to orthodontics.

Dr. David Slade announces the opening of his office at Suite 615, Medical Arts Bldg., 16th and Walnut Sts., Philadelphia, Pa., practice limited to orthodontics.

Walter W. Winter, D.D.S., announces an association with James E. Williams, D.M.D., in the practice of orthodontics at 369 West Prairie Ave., Decatur, Ill.

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The AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

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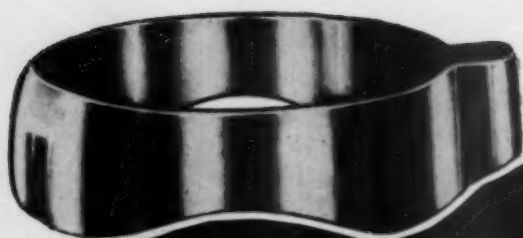
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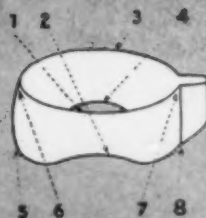
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Published by THE C. V. MOSBY COMPANY, 3207 Washington Blvd.
St. Louis 3, U. S. A.

Entered at the Post Office at St. Louis, Mo., as Second-class Matter

Published Monthly, Subscriptions may begin at any time.

Official Publication of The American Association of Orthodontists,
its component societies and The American Board of Orthodontics

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